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WATER RESOURCES ABSTRACTS

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VOLUME 14, NUMBER 1
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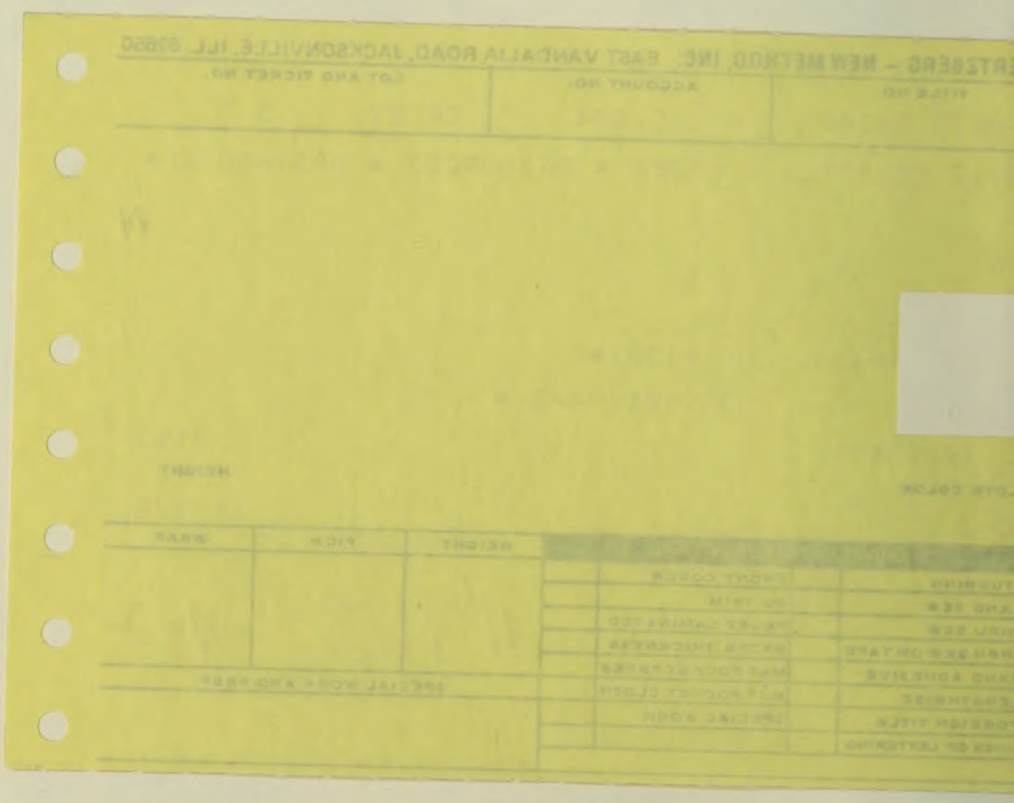

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SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

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Volume 13, Numbers 22 and 23, and 24 are combined in this issue.

384-5

SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

VOLUME 14, NUMBER 1
JANUARY 1, 1981

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Office of Water Research and Technology. The cumlative SWRA file from 1968 and montlhy updates are available also in magnetic tape through lease from NTIS.

THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

PREDICTION OF BASEFLOW FOR PIEDMONT WATERSHEDS,
Clemson Univ., SC. Water Resources Research Inst.
T. V. Wilson, and J. T. Ligon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119091, Price codes: A04 in paper copy, A01 in microfiche. Report No 80, November, 1979. 47 p, 14 Fig, 4 Tab, 4 Ref, 1 Append. OWRT-A-034-SC(1).

Descriptors: *Base flow, *Watersheds, *Mathematical models, *Forecasting, *Excess water(Soils), Moisture uptake, Moisture content, Base runoff, Groundwater discharge, Groundwater flow, Groundwater runoff, Flow, Drainage divides, Basins, Drainage systems, Computer models, Statistics, Statistical methods, Soil moisture, Model studies.

Ability to accurately predict baseflow rates under adverse weather conditions would be beneficial in systems planning for water supplies, pollution dispersion and removal, and recreational facilities. Four Piedmont watersheds and one Sandhill watershed, all unregulated flow, were selected for this study, which used a previously-developed baseflow model to estimate daily baseflow regimes for Piedmont watersheds. Two factors that appeared to give most trouble were (1) the lack of representative watershed precipitation data, and (2) the inability to use simple relationships to estimate surface runoff (which was not part of baseflow). The watersheds were divided into upper and lower zones based on the approximate depth to the water table. Using the nearest available precipitation data, estimated daily evapotranspiration rates, estimated surface runoff, and root zone soil moisture storage capacity, a daily soil moisture balance was used to calculate excessive soil moisture (EXSM); water assumed to contribute to saturated water storage and ultimate baseflow. All baseflow was assumed to be derived from EXSM. A simplified approach permitted the many variable watershed characteristics to do the integrating, and gave results that were reasonably good estimates of baseflow. (Zielinski-IPA)
W81-00197

2B. Precipitation

WEATHER FORECAST NEEDS FROM THE VIEWPOINT OF HYDROLOGY,
Geological Survey, Reston, VA. Water Resources Div.
D. M. Thomas, and T. J. Buchanan.
Available from OFSS, Box 25425, Fed. Ctr., Denver, CO. 80225, Paper copy $1.00, Microfiche $3.50. Geological Survey Open-File Report 80-754, 1980. 10 p, 6 Ref.

Descriptors: *Weather forecasting, *Hydrology, *Meteorology, *Flood forecasting, Reservoir operation, Reliability, Water supply, Water quality, Acid rain.

Hydrologists now depend on directly observed data in their forecasting and only infrequently use meteorological forecasts. Case studies show how reliable meteorological forecasts could be beneficial in flood and drought situations. Hydrologists need meteorological forecasts that recognize spatial variability, that are unbiased, and that have a specified degree of uncertainty. (USGS)
W81-00070

FIELD SITE DIRECTION OF PREPARATORY OBSERVATION FOR DETERMINING EFFECTIVENESS OF PROGRAM OF APPLIED WEATHER MODIFICATION IN THE CANARY ISLANDS,
AIRAO, Inc., Pagosa Springs, CO.
A. H. Schnell.
Completion Report prepared for Water and Power Resources Services, December 12, 1979. 85 p, 9 Ref, 3 Append. 0-07-85-V0031.

Descriptors: *Weather modification, *Climatology, *Meteorological data, Cloud cover, *Islands, Measurement, Dropwise condensation, Artificial precipitation, *Cloud seeding, Meteorology, Precipitation(Atmospheric), Rain, Storms, Water supply, Weather, Clouds, Convections, Nucleation, Weather patterns, Radar, Instrumentation, Remote sensing, *Canary Islands.

This report describes work conducted during the period of December 1979 through July 1980 on field site direction of preparatory observation for determining the effectiveness of a program on applied weather modification in the Canary Islands. Work carried out during this period consisted of observation of small convective systems within the sea of clouds over the Canarian Archipelago, using ground-based radar and airborne instrumentation and cloud condensation nuclei counter and simple drop-recording equipment. These observations fell under a preliminary studies phase. The three basic cloud types that were identified were warm sea clouds, warm orographic clouds, and cold clouds. The limited number of case studies obtained and the numerous observations made during the course of this project seemed to suggest that, for eventual future programs of Applied Weather Modification, especially over the eastern province of the Canary Archipelago, use of materials and techniques to enhance vertical development of isolated cells should be handled with extreme caution. A number of other recommendations related to potential weather modification activities were presented. (Zielinski-IPA)
W81-00096

STANDARD INTENSITY CURVES FOR RAINFALL OF SHORT DURATION (STANDAARD INTENSITEITSKROMMES VIR REENVAL VAN KORT DUURTES),
Bruinette, Kruger, and Stofberg, Johannesburg (South Africa).
W. M. Van Heerden.
The Civil Engineer in South Africa (Johannesburg), Vol 20, No 10, p 261-267, 1978. 11 Fig, 1 Tab, 12 Ref.

Descriptors: *Rainfall intensity, *Duration curves, *Frequency curves, *Classification, Precipitation(Atmospheric), Rates, Meteorology, Precipitation intensity, Mapping, Geolographical regions, Evaluation, Time, Time series analysis, Mathematical studies, Gaging stations, Data collections, Rating curves, *South Africa.

Eight sets of rain intensity-duration-return period curves applicable any place in South Africa are grouped according to intensities. The rainfall events with durations of 5 to 60 minutes, with a point value of 120 minutes, are given on the x-axis and the intensities are given by the values on the y-axis. Rainfall data from sixty-two gaging stations can be used to establish the class of the intensity or one of the existing methods used for intensity determination may be employed. The eight classes of intensities were derived from data previously reported in the literature and the distribution of intensities in relation to duration and frequency is applicable to rainfall analysis in the U.S. and other countries. (Sidney-IPA)
W81-00208

2C. Snow, Ice, and Frost

PRELIMINARY BATHYMETRY OF MC CARTY FIORD AND NEOGLACIAL CHANGES OF MC CARTY GLACIER, ALASKA,
Geological Survey, Tacoma, WA. Water Resources Div.
A. Post.
Geological Survey Open-File Report 80-424, 1980. 4 Sheets.

Descriptors: *Bathymetry, *Glaciers, *Alaska, *Glacial drift, *Icebergs, Glacial sediments, Fjords, Scour, Dating, Glaciology, Hydrography, Maps, Profiles, *McCarty Glacier(AK), *McCarty Fiord(AK).

Preliminary bathymetry (at 1:20,000 scale) and other scientific studies of McCarty Fiord, Alaska, Conducted by the Research Vessel Growler in 1978, showed this 15 mile-long waterway to be a narrow, deeply scoured basin enclosed by a terminal-moraine shoal. This valley was formerly filled by McCarty Glacier, which began a drastic retreat shortly after 1909; the glacier reached shallow water at the head of the fiord around 1960. The relative rate of retreat in deep water and on land is disclosed by the slower melting of stagnent ice left in a side valley. Soundings and profiles show the main channel to extend to a depth as great as 957 feet and to have the typical 'U' shape of a glacier-eroded valley; since the glacier's retreat, sediments have formed a nearly level deposit in the deepest part of the fiord. Old forest debris dated by carbon-14 indicates that a neoglacial advance of the glacier began before 3,395 years B.P. (before present); by 1,500 B.P. the glacier filled most of the fiord, and before the glacier culminated its advance around 1860, two glacier-dammed lakes were formed in side valleys. (USGS)
W81-00056

PRELIMINARY BATHYMETRY OF AIALAK BAY AND NEOGLACIAL CHANGES OF AIALIK AND PEDERSON GLACIERS, ALASKA,
Geological Survey, Tacoma, WA. Water Resources Div.
A. Post.
Geological Survey Open-File Report 80-423, 1980. 1 Sheet.

Descriptors: *Bathymetry, *Glaciers, *Alaska, *Glacial drift, *Icebergs, Glacial sediments, Fjords, Scour, Dating, Glaciology, Hydrography, Maps, Profiles, *Aialik Bay(AK), Aialik Glacier(AK), Pederson Glacier(AK).

Preliminary bathymetry (at 1:20,000 scale) and scientific studies of Aialik Bay, Alaska, by the Research Vessel Growler in 1978 disclose that the head of the bay consists of a deep basin enclosed by a terminal-moraine shoal. A much smaller basin, into which Aialik Glacier discharges icebergs, is located west of two islands and a submarine ridge. Comparison of 1978 soundings with U.S. Coast and Geodetic Survey (now National Oceanic and Atmospheric Administration) data obtained in 1912 shows shoaling of about 64 feet in the deepest part of the small basin nearest the glacier and of about 40 feet in the large basin. The time of retreat of Aialik Glacier from the moraine bar is unknown; a faint 'trimline' is still visible in the forest on the east side of the fiord, and a carbon-14 date suggests the retreat could have taken place as recently as 1800. The time of Aialik Glcier's neoglacial advance to the moraine is unknown. Pederson Glacier, which terminates in part in a tidal lagoon or lake, has retreated about 0.90 mile from a moraine judged by Grant and Higgins to have been in contact with the ice about 1896. (USGS)
W81-00057

WATERSHED INFORMATION SYSTEM,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
For primary bibliographic entry see Field 7B.
W81-00081

PRELIMINARY BATHYMETRY OF BLACKSTONE BAY AND NEOGLACIAL CHANGES OF BLACKSTONE GLACIERS, ALASKA,
Geological Survey, Tacoma, WA. Water Resources Div.
A. Post.
Geological Survey Open-File Report 80-418, 1980. 2 Sheets.

Descriptors: *Bathymetry, *Glaciers, *Alaska, *Glacial drift, *Icebergs, Glacial sediments, Fjords, Scour, Dating, Glaciology, Hydrography, Maps, Profiles, *Blackstone Bay(Alaska).

Preliminary bathymetry (at 1:20,000 scale) and scientific studies of Blackstone Bay Alaska, by the Research Vessel Growler in 1978 disclose that the head of the bay consists of two basins separated by

Willard Island and a submarine ridge. Both basins are closed on the north by terminal-moraine bars where Blackstone Glacier and its tributaries terminated as recently as about A.D. 1350; a carbon-14 date of 580 years before present on Badger Point, and old trees farther up the bay, disclose that the glaciers retreated to two narrow inlets at the head of the bay before 1400. The inlets were still glacier-covered until at least 1909. Glaciers in both inlets have continued to retreat; at present they terminate at the head of tidewater, where they discharge small icebergs. Only relatively thin sediments have accumulated in the eastern basin south of the terminal-moraine bar, and most of the bottom is hard and irregular as disclosed by soundings and profiles. The northern part of Blackstone Bay is very deep; at more than 1,100 feet below sea level a large, level accumulation of sediment is present which is presumably as much as 1,000 feet deep and has been accumulating since late Pleistocene glaciers retreated. (USGS)
W81-00138

PRELIMINARY BATHYMETRY OF NORTHWESTERN FIORD AND NEOGLACIAL CHANGES OF NORTHWESTERN GLACIER, ALASKA,
Geological Survey, Tacoma, WA. Water Resources Div.
A. Post.
Geological Survey Open-File Report 80-414, 1980. 2 Sheets.

Descriptors: *Bathymetry, *Glaciers, *Alaska, *Glacial drift, *Icebergs, Glacial sediments, Fjords, Scour, Dating, Glaciology, Hydrography, Maps, Profiles, *Northwestern Glacier(AL), *Northwestern Fiord(AL).

The first preliminary bathymetry (at 1:20,000 scale) and other scientific investigations of Northwestern Fiord, Alaska, were conducted by the Research Vessel Growler in 1978, disclosing this 10.5-mile-long branched waterway to be a deep basin enclosed by a terminal-moraine shoal. The basin was formerly filled by Northwestern Glacier, which began a drastic retreat around 1909 and reached the head of the main arm around 1960. Soundings and profiles show the main channel to be as much as 970 feet deep and to have the typical U shape of a severely glacially eroded valley; since the glacier's retreat, sediments have formed nearly level deposits in the deepest reaches, while the rest of the basin has a hard, rocky bottom. Preneoglacial forest debris dated by carbon-14 indicates Northwestern Glacier to have advanced into the fiord prior to 1,385 years before present (B.P.); a branch glacier evidently advanced into forest 1,635 years B.P. The combined glaciers from several arms culminated on the present terminal-moraine shoal around 1894. (USGS)
W81-00140

2D. Evaporation and Transpiration

WEATHER AND EVAPOTRANSPIRATION STUDIES IN A SALTCEDAR THICKET, ARIZONA,
Geological Survey Tucson, AZ. Water Resources Div.
T. E. A. van Hylckama.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $4.00.

Descriptors: *Evapotranspiration, *Tamarisk, *Phreatophytes, *Hydrologic budget, *Water utilization, Analytical techniques, Vegetation, Riparian plants, Consumptive use, Water loss, Hydrologic cycle, Environmental effects, Climatology, Soil moisture, Transpiration, Evaporation, Soil-water-plant relationships, Lysimeters, Arizona, Aerodynamic resistance, Stomatal Resistance.

It is often assumed that flood-plain and riparian vegetation transpires large quantities of water. Because of the large area it occupies in the southwestern United States, saltcedar is especially suspected of doing so. The quantities of water transpired from small areas can be measured directly with evapotranspirometers or lysimeters, but can be determined indirectly faster and more efficiently if valid correlations can be established between such readily measureable ambient inputs as radiation and windspeed and the reaction of plants to such inputs. Observations of environmental conditions and of water use by saltcedar (Tamarix chinensis) were made over a 6-year period. Rough estimates of water use can be made for periods of a month or longer by the use of a few simple methods involving only a few ambient parameters. For precise prediction of water use much more elaborate measurement and recording equipment is necessary, and aerodynamic and stomatal resistances must be taken into account. Although there may be times and locations where transpiration rates are high, there are reasons to believe that vegetation management with the goal of slavaging transpiring water may often not be economically warrented. (USGS)
W81-00157

2E. Streamflow and Runoff

METHODS OF LOW FLOW PREDICTIONS FOR SMALL GEORGIA STREAMS,
Georgia Inst., of Tech., Atlanta.
J. R. Wallace, G. N. Day, W. R. Howard, Jr., and K. J. Wiederkhr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-109779, Price codes: A08 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology Report, ERC 03-80, April 1980, 144 p, 55 Fig. OWRT-B-130-GA(1), 14-34-0001-7114.

Descriptors: *Low flow, Droughts, *Runoff forecasting, *Georgia, Streams, *Model studies, Small watersheds, Low flow predictions, Ungaged streams, Waste assimilative capacity, Watershed simulation, Precipitation models.

Low flow in Georgia streams was estimated for use in determining waste assimilative capacity, the amount of oxygen-consuming waste that can be released into a stream without violating water quality standards. Low flow data are also needed for allocation of this resource during times of scarcity. Several approaches to the analysis and prediction of low flow were examined. The first used the concept of a deterministic watershed simulation model to estimate stream flow. The model developed was used to simulate six watersheds in Georgia, two in the mountains, two in the Piedmont and two in the Coastal Plain. Simulated low flows were considerably more accurate for some watersheds than for others. Another approach was statewide estimation of low flow based on data at more than 150 continuous and partial record gaging stations. Zones with similar 7-day average low flow were outlined for different return periods. The potential for using the correlation between precipitation and low flow as a method for predicting low flow was investigated. It was concluded that stream flow-precipitation correlation methods hold promise as a technique for estimating low flows. Analysis of the techniques examined in this investigation led to the conclusion that maps showing zones of average low flow represent best currently available method for estimating low flow in Georgia streams. It is recommended that these maps be used when estimates of low flow are needed on ungaged streams.
W81-00005

FREQUENCY OF AGRICULTURAL AND FOREST DROUGHT IN NEW HAMPSHIRE: 1926 - 1975,
Northeastern Forest Experiment Station, Durham, NH.
For primary bibliographic entry see Field 7B.
W81-00034

LIMITED CONFIDENCE IN CONFIDENCE LIMITS DERIVED BY OPERATIONAL STOCHASTIC HYDROLOGIC MODELS -- COMMENTS,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
J. Stedinger.
Journal of Hydrology, Vol 47, p 377-380, 1980. 8 Ref. OWRT-A-085-NY(2).

Descriptors: *Streamflow, *Model studies, *Synthetic hydrology, *Stochastic processes, *Statistical methods, Hydrology, River forecasting, Mathematical studies, Sampling, Probability, Statistical models, Time series analysis, Optimization, Statistics, Estimating, Evaluation.

The purpose of this commentary paper was to explain why the results of a study reported earlier by Klemes and Bulu (Journal of Hydrology, Vol 42, p 9-22, 1970) demonstrating that standard procedures for synthetic streamflow generation fail to generate flows which capture the likely range of the sample moments of future streamflow sequences, should have been expected. The Klemes-Bulu study showed that, in particular, the means and standard deviations of monthly flows calculated using the second, third, and fourth 25-year streamflow segments (of four 25-year segments of a 100-year streamflow record) too frequently fell outside 95% confidence intervals. Monthly streamflow models used in the earlier study that reproduce only between month correlations of flows in nearby months often underestimate the year-to-year correlations of annual flows, and for a given month, the variance of the difference between a sample mean and its modeled value is greater than the modeled variance of the generated means used to construct the confidence intervals. A reply prepared by Klemes and Bulu appears in the same issue (Journal of Hydrology, Vol 47, p 381-383, 1980), clarifying this modeling presentation approach in explanation to these comments. (Zielinski-IPA)
W81-00047

AQUIFER RECHARGE FROM THE 1969 AND 1978 FLOODS IN THE MOJAVE RIVER BASIN, CALIFORNIA,
Geological Survey, Menol Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-00052

EFFECTS OF AGRICULTURAL DRAINAGE DEVELOPMENT ON BENTHIC INVERTEBRATES IN UNDISTURBED DOWNSTREAM REACHES,
Minnesota Univ., St. Paul.
For primary bibliographic entry see Field 5C.
W81-00103

CONSERVATION AND FLOW MAINTENANCE DURING DROUGHT,
Rutgers - The State Univ., Brunswick, NJ. Water Resources Research Inst.
W. Whipple.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 103-116, 1979. 5 Fig, 5 Ref.

Descriptors: *Water conservation, *Droughts, *Flow rates, *Environmental effects, Water policy, Planning, Urbanization, Forecasting, Water rights, Water supply, Water resources development, Runoff, Recharge, Groundwater, Hydrology.

Water supply planning, water quality planning, and comprehensive basin planning are needed to prevent further erosion of environmentally necessary flows during periods of drought. Water supply planners and managers are apt to consider the total quantity of water carried by a stream at any given time to be available for use without consideration of the maintenance of environmental streamflow needs. To combat this situation a comprehensive approach is needed involving tradeoffs between reductions in customer demand, maintenance of environmental stream flow needs, and levels of capital investment in improved facilities. Present Western water laws make this type of approach difficult and appropriate Eastern water laws do not exist. Too often overt conflicts are avoided by making unacknowledged over-appro-

priations. While the establishment of minimum flows is important, it is, however, unrealistic to insist that these flows be maintained under any conceivable conditions. Streams will recover rapidly in most cases if they have zero flow for a few days. Extended zero flow would cause more serious environmental damage. Projections of future hydrology indicate that with development total water available from surface runoff and ground supplies will increase, but more of it will be as flood flows. Natural drought flows and groundwater recharge will be reduced. These forecasts must be considered when planning for future water supplies. (See also W81-00160) (Seigler-IPA)
W81-00172

THE NWS EXTENDED STREAMFLOW PREDICTION TECHNIQUE,
National Weather Service, Silver Spring, MD.
D. C. Curtis, and J. C. Schaake.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 182-195, 1979. 2 Fig, 1 Tab, 17 Ref.

Descriptors: *Forecasting, *Model studies, *Mathematical models, Streamflow forecasting, Channel flow, Routing, River forecasting, Low-flow frequency, Regression analysis, Droughts, Hydrologic data, Hydrology, Evapotranspiration, Computer models.

The Extended Streamflow Prediction Model (ESP) is a stochastic dynamic model using conceptualizations of catchment hydrology with historical data to produce probabilistic estimates of future streamflows. ESP has a more physically based approach than common regression methods through the use of the conceptual hydrologic model. ESP provides for a more complete description of watershed physics and a probabilistic analysis of model outputs. The model eliminates many of the weaknesses of regression analysis type techniques and is more flexible. ESP utilizes data from the National Weather Service River Forecast System including mean areal precipitation, mean areal temperature, and mean areal evapotranspiration. There are three major hydrologic and hydraulic computational elements, soil moisture accounting, snow accumulation and ablation, and channel routing. Data required other than program control and option information include hydrological model parameters, initial basin conditions, and representative future time series inputs. Two examples given of the use of ESP are the California drought of 1976-1977 and the northern Virginia drought of 1977. Areas for future research include optimal state estimation, short and long term weather forecasts, model error analysis, model output analysis, and analysis of economic impact. (See also W81-00160) (Seigler-IPA)
W81-00182

PREDICTION OF BASEFLOW FOR PIEDMONT WATERSHEDS,
Clemson Univ., SC. Water Resources Research Inst.
For primary bibliographic entry see Field 2A.
W81-00197

SHIFTING LEVEL MODELLING OF HYDROLOGIC SERIES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. D. Salas, and D. C. Boes.
Advances in Water Resources, Vol 3, No 2, p 59-63, June, 1980.

Descriptors: *Hydrologic data, *Computer models, *Flow measurement, *Time series analysis, *Stochastic processes, Low-flow frequency, Non-uniform flow, Correlation analysis, Application methods, Simulation analysis, Rivers.

The potential use of shifting level models of time series hydrologic data is discussed, and deficit and run properties are compared with those of certain autoregressive (ARMA) models. Though still in a developmental stage, the shifting level model is better able to reproduce droughts, floods, and other natural, abrupt shifts in streamflow for long-term historical records. Potential applications include modelling the hydrology of equatorial lakes, of sea-current effects along equatorial coastlines, and hydrologic changes related to natural disturbances such as forest fires, earthquakes, landslides and changes in land use. The model is based on a sequence of random variables whose values represent the different levels of streamflow over random time spans. The correlation function of this model is composed of a low-frequency component due to the random shifts of level. When simplified, the correlation structure is identical to that of the ARMA model. In a comparison of shifting level and ARMA models, based on annual flows of the Niger River, it was found that mean maximum accumulated deficit, mean longest negative run length, and mean largest negative run sum for both models are similar. However, variances for the shifting level model are greater than the corresponding variances of the ARMA model. (Titus-FRC)
W81-00207

THE ORGANIZATIONAL PATTERN OF BALTIC MARINE SCIENCE,
Havsfiskelaboratoriet, Lysekil (Sweden).
B. I. Dybern.
Ambio, Vol 9, No 3-4, p 187-193, 1980.

Descriptors: *Organizations, *Research and development, *Baltic Sea, Marine biology, Oceanography, Oceans, Administrative agencies, International commissions, Water pollution control, Research facilities, Conferences.

International cooperative bodies which are dealing with Baltic marine problems are named and a brief description of the functions of each body is given. Bodies confined to the Baltic Sea area are the International Baltic Sea Fishery Commission, Committee for the Gulf of Bothnia, Conferences of Baltic Oceanographers, Baltic Marine Biologists, and the ICES/SCOR Working Group on the Study of Pollution of the Baltic. Bodies covering a larger area than the Baltic but with sub-bodies for the Baltic are the International Council for the Exploration of the Sea, International Hydrological Program of UNESCO, Council for Mutual Economic Assistance, Scientific-Technological Cooperation Committee between Finland and the USSR, and the Scientific Committee on Oceanic Research. The Nordic Council, Nordic Council of Ministers, Nordic Council for Marine Biology, Nordic Council for Physical Oceanography, Commission for Economic and Technological-Scientific Cooperation between Denmark and the USSR, and the Soviet-Swedish Committee on Economic, Scientific and Technological Cooperation have wider coverage than the Baltic but have great impact on Baltic research. About half the approximately 350 scientists (mostly biologists and oceanographers) who devote most of their time to Baltic marine science work for one or more of these bodies. Each year, there are 20-25 international meetings on the Baltic. There are about 25 marine research institutions along the Baltic coasts, and about 20 research vessels working on the sea. The author urges that the rigidity of the present structure be relaxed and many scientists allowed to give more of their time to science rather than to organization. (Baker-FRC)
W81-00209

2F. Groundwater

AQUIFER RECHARGE FROM THE 1969 AND 1978 FLOODS IN THE MOJAVE RIVER BASIN, CALIFORNIA,
Geological Survey, Menol Park, CA. Water Resources Div.
A. Buono, and D. J. Lang.
Available from OFSS, Box 25425, Fed. Ctr., Denver, CO. 80225, Paper copy $5.00, Microfiche $4.00. Geological Survey Open-File Report 80-207 (WRO), April 1980. 25 p, 11 Fig, 3 Tab, 14 Ref.

Descriptors: *Groundwater recharge, *Floods, *California, *Streamflow, *Water lvels, Aquifers, Water wells, Flood recurrence interval, Precipitation excess, Surface runoff, Peak dicharge, Flood damage, Hydrographs, *Mojave River basin(CA), *San Bernardino County(CA).

The Mojave River basin, a high desert area in southwestern San Bernardino County, Calif., received 2.3 times the normal annual precipitation during the 1969 and 1978 water years. Precipitation in the mountainous upper part of the watershed is the primary source of flow in the Mojave River. The resulting floods had an instantaneous peak discharge of 18,000 cubic feet per second in 1969, about 100 miles downstream, representing the maximum flood-recurrence interval in the basin of 30 years. The instantaneous peak measured during the 1978 floods at Deep Creek represented the maximum flood-recurrence interval in the basin of 20 years. A comparison of the hydrologic data for the 1969 and 1978 flood periods indicates that although more precipitation occurred in 1969, more recharge occurred in 1978. The factors that caused the greater recharge were: (1) The more evenly distributed precipitation from December 1977 to April 1978, allowing for more uniform surface-water runoff in the Mojave River; (2) the dams constructed in the upper basin after 1969 which regulated floodflow peaks and allowed more water to stay in the basin; and (3) the lower water level in the aquifer in 1978, which made more space available to store the recharge water. Total recharge resulting from the floods is estimated to have been 245,000 acre-feet in the 1969 water year and 282,000 acre-feet in 1978. (USGS)
W81-00052

SURFICIAL GEOLOGY OF PENNELLVILLE QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00055

A QUASI THREE-DIMENSIONAL FINITE-DIFFERENCE GROUNDWATER FLOW MOEL WITH A FIELD APPLICATION,
Maryland Geological Survey, Towson.
G. Achmad, and J. M. Weigle.
Report of Investigations No 33, 1979. 57 p, 22 Fig, 1 Tab, 19 Ref, 4 Append.

Descriptors: *Model studies, *Groundwater, *Flow, *Mathematical models, *Simulation analysis, Aquifers, Aquicludes, Leakage, Aquifer systems, Pumping, Water level fluctuations, Observation wells, Hydrographs, Maryland, Computer programs, *Quasi three-dimensional flow, Finite difference, Worcester County(MD).

This report describes a quasi three-dimensional model which was constructed from a sequence of aquifer areal-flow equations coupled by leakage terms representing flow through the confining beds. In simulating a four-aquifer system in northeastern Worcester County, Md., the model was able to reproduce the hydrographs of several observation wells with differences of less than 1 foot for 60 percent and less than 5 feet for 95 percent of the data points. The computer program of the model is given in the appendices. (USGS)
W81-00058

PLAN OF STUDY FOR THE NORTHERN ATLANTIC COASTAL PLAIN REGIONAL AQUIFER SYSTEM ANALYSIS,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 6A.
W81-00068

FRESHWATER RESOURCES OF BIG PINE KEY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2L.
W81-00069

GROUND WATER FLOW SYSTEMS IN THE PHOSPHATE SEQUENCE, CARIBOU COUNTY, IDAHO,
Idaho Univ., Moscow. Water Resources Research Inst.
G. V. Winter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113078, Price codes: A07 in paper copy, A01 in microfiche. Technical Report, March, 1980. 120 p, 45 Fig, 14 Tab, 32 Ref, 5 Append. OWRT-C-7651(No 7253)(5).

Descriptors: Groundwater, Groundwater availability, *Geologic control, *Phosphates, *Geologic formations, Subsurface waters, Idaho, Groundwater resources, *Groundwater movement, Groundwater barriers, *Hydrogeology, Phosphorus, Phosphorus compounds, Geology, Groundwater basins, Hydrology, Rocks, *Caribou County(ID).

Potential impact of phosphate mining on the hydrogeology/hydrology of an area can only be evaluated if the capability of the formations to support groundwater flow systems is understood. A study was conducted to evaluate this capability in the study area, and to test the hypothesis that similar systems exist within the phosphate sequence of geologic units (Dinwoody, Phosphoria, and Wells Formations) throughout a large area of the Western Phosphate Field of Caribou County, Idaho. It was concluded that the formations comprising the phosphate sequence exhibited similar hydrogeologic characteristics throughout the study area. Support for major groundwater flow systems were noted for the upper and lower members of the Dinwoody and Wells Formations. Groundwater flow systems above the Phosphoria Formation were separated from those below the Formation, causing the upper flow systems to be local in extent and the lower flow system to be regional. Findings for the presence/absence of other groundwater flow systems were included. The groundwater information derived from this study should be transferable to other areas where this phosphate sequence is present. Minor variations of the flow system characteristics may occur with variations in physical composition of the formations. (Zielinski-IPA)
W81-00072

A GEOCHEMICAL AND HYDROLOGICAL INVESTIGATION OF GROUNDWATER RECHARGE IN THE ROSWELL BASIN OF NEW MEXICO: SUMMARY OF RESULTS AND UPDATED LISTING OF TRITIUM DETERMINATIONS,
New Mexico Inst. of Mining and Technology, Socorro.
G. W. Gross, and R. N. Hoy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-114647, Price codes: A07 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces. Report No. 122, April 1980. 141 p, 3 Fig, 12 Ref, 1 Append. OWRT-A-055-NMEX(4).

Descriptors: *Groundwater recharge, *Tritium, *Hydrologic budget, *Basins, New Mexico, Hydrogen radioisotopes, Deuterium, Radioactivity, Groundwater, Recharge, Natural recharge, Infiltration rates, Inflow, Precipitation(Atmospheric), Geochemistry, Groundwater basins, Stochastic processes, *Roswell basin(NM), Surface-groundwater relationships.

Different approaches were used to study recharge and flow patterns in the Roswell, New Mexico, artesian basin. Isotope determination for tritium, deuterium, and oxygen-18 were made as a function of time and space. Observation well levels, springflow, and precipitation were analyzed by stochastic/numerical approaches. Also, a hydrogeologic survey was made of representative springs in the recharge zone on the basin western flank. An updated listing of tritium activity in precipitation, springs, surface runoff, and subsurface water from over 120 sampling sites in the basin covers 117 pages of the report, and supersedes and continues that reported earlier by the same investigators. Detailed interpretation of the tritium data, while remaining to be done, is expected to yield answers to questions on the effect of basin pumpage on deeper (older) water leakage, on the residence time of groundwater in the southern (Artesia) part of the basin, and on the role of the structure zones in recharge to the Principal Aquifer. The accumulated evidence indicated that the contribution of the Principal Intake Area to the basin recharge was overestimated in the past. Substantial deep leakage contributions from the basin western flank must be included to account for the basin groundwater budget. (Zielinski-IPA)
W81-00078

LINEAR SYSTEM MODELS FOR REGIONAL AQUIFER EVALUATION STUDIES,
Parsons, Brinckerhoff, Quade and Douglas, Inc., New York.
C. T. Bathala, A. R. Rao, and J. A. Spooner.
Water Resources Research, Vol 16, No 2, p 409-422, April 1980. 11 Fig, 9 Tab, 17 Ref. OWRT-C-3277(No 3713)(16) and C-6106(No 5213)(13).

Descriptors: *Aquifer characteristics, *Mathematical models, *Groundwater movement, Hydraulic properties, Model studies, Equations, Storage coefficient, Transmissivity, Surface-groundwater relationships, Pumping, Drawdown, Water levels, Water wells, Well spacing, *Linear systems, Aquifer-stream systems, Regional aquifer systems, Sensitivity analysis.

A generalized linear system model was formulated to analyze several types of groundwater flow problems. An iterative procedure was developed to predict aquifer response due to pumping demand by considering the analytical relationships governing the groundwater flow. Historical pumping rates, groundwater levels, stream stages, and estimated storage coefficients were used as inputs to the model. The model outputs were the aquifer transmissivities and the predicted groundwater levels. The sensitivity of the model to variations in the estimated storage coefficients was investigated. The technique was illustrated by considering a realistic but hypothetical regional aquifer system, and the results were demonstrated to be satisfactory. The technique is insensitive even to large errors in the estimated storage coefficients. The number of simultaneous equations to be solved and hence the computational time required are much smaller than those encountered un the conventional numerical models of aquifer systems. Aquifer transmissivity and storage coefficient values are computed as a part of this procedure, therefore, expensive pumping tests that are usually required to estimate these aquifer parameters are not necessary in this technique. (Visocky-ISWS)
W81-00105

POTENTIOMETRIC SURFACE OF FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND ADJACENT AREAS, MAY 1979,
Geological Survey, Tampa, FL. Water Resources Div.
R. M. Wolansky, L. R. Mills, W. M. Woodham, and C. P. Laughlin.
Geological Survey Open-File Report 79-1255, 1979. 1 Sheet.

Descriptors: *Maps, *Aquifers, *Water levels, *Potentiometric level, *Florida, Water wells, Water utilization, Irrigation, Water level fluctuations, *Floridan aquifer, Southwest Florida Water Management.

A May 1979 potentiometric-surface map depicts the annual low water-level period. Potentiometric levels declined 4 to 21 feet between September 1978 and May 1979, in the citrus and farming sections of southern Hillsborough, northern Hardee, southwestern Polk, northwestern DeSoto, and Manatee Counties. Water levels in these areas are widely affected by pumping for irrigation and have the greatest range in fluctuations. Water-level declines ranged from 0 to 6 feet in coastal, northern, and southern areas of the Water Management District. Generally potentiometric levels were higher than previous May levels due to heavy rains in April and May. In parts of Hillsborough, Pasco, and Pinellas Counties, May 1979 potentiometric levels were 18 feet higher than those of September 1978. (USGS)
W81-00141

SEASONAL AND ANNUAL VARIATIONS IN THE POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER IN DUVAL COUNTY, FLORIDA, 1960-77,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00142

GROUND WATER IN OSCEOLA COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00143

CONFIGURATION OF THE TOP OF THE HIGHLY PERMEABLE DOLOMITE ZONE OF THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00144

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1980,
Geological Survey, Salt Lake City, UT. Water Resources. Div.
L. R. Herbert.
Utah Division of Water Resources Cooperative Investigations Report No 19, 1980. 72 p, 39 Fig, 3 Tab, 2 Ref.

Descriptors: *Groundwater resources, *Utah, *Aquifers, *Withdrawal, *Water level fluctuations, Water quality, Water wells, Water utilization, Water supply, Irrigation, Hydrogeology, Water table, Potentiometric level, Grondwater recharge, Hydrologic data, Precipitation(Atmospheric), Surface-groundwater relationships, Hydrographs, Maps.

This is the seventeenth in a series of annual reports that describe groundwater conditions in Utah. The estimated total withdrawal of water from wells in Utah in 1979 was about 860,000 acre-feet--about 31,000 acre-feet more than in 1978 and 73,000 acre-feet more than the average annual withdrawal during 1969-78. The increase in withdrawal from the amount reported for 1978 was due primarily to increases in withdrawal for public supply. Total withdrawal for public supply in 1979 was about 162,000 acre-feet, which is 33,000 acre-feet more than reported for 1978. Withdrawal for irrigation was 567,000 acre-feet, an increase of 5,000 acre-feet. The quantities closely related to local climatic conditions. Precipitation in 1979 was below average in most of Utah (Natio of water withdrawn from wells are nal Oceanic and Atmospheric Administration, 1980). Of the 33 stations for which graphs of cumulative departure from average annual precipitation are included in this report, 27 had below-average precipitation in 1979. This contributed most significantly to increased withdrawals from wells during 1979. The below-average precipitation in most parts of the State during 1979 resulted in local reduction in ground-water recharge as well as increased withdrawals from wells. This in turn resulted in a general decline of ground-water levels in many parts of the State from spring of 1979 to spring of 1980. Notable exceptions where rises occurred were in areas where local above-average runoff contributed greatly to the recharge of the groundwater reservoir. The total number of wells drilled during 1979, as indicated by well-drillers' reports filed with the Utah Division of Water Rights, was about 35 percent less than reported for 1978. The number of those wells 6 inches or more in diameter drilled for public supply irrigation, and industrial use was about 28 percent less than reported for 1978. (USGS)

W81-00150

GEOLOGIC AND HYDROLOGIC DATA FROM A TEST-MONITOR WELL AT FERNANDINA BEACH, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-00151

HYDROLOGIC MONITORING PROGRAM IN ELDRIDGE-WILDE AND EAST LAKE ROAD WELL-FIELD AREAS, PINELLAS AND HILLSBOROUGH COUNTIES, FLORIDA, 1977 WATER YEAR,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-00153

MAPS SHOWING GROUND-WATER CONDITIONS IN THE DOUGLAS BASIN AREA, COCHISE COUNTY, ARIZONA--1978,
Geological Survey, Tucson, Az. Water Resurces Div.
For primary bibliographic entry see Field 7C.
W81-00155

MAPS SHOWING GROUND-WATER CONDITIONS IN THE UPPER VERDE RIVER AREA, YAVAPAI AND COCONINO COUNTIES, ARIZONA--1978,
Geological Survey, Tucson, Az. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00156

GROUND-WATER DATA FOR BILLINGS, GOLDEN VALLEY AND SLOPE COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-00158

GROUND-WATER RESOURCES OF DICKEY AND LA MOURE COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-00159

2G. Water In Soils

PREDICTING THE EFFECTS OF CHANGING WATER-TABLE LEVELS AND ASSOCIATED SOIL MOISTURE REGIMES FOR SOIL SURVEY INTERPRETATIONS,
Soil Survey Inst., Wageningen (Netherlands).
J. Bouma, P. J. M. de Laat, A. F. van Holst, and Th. J. van de Nes.
Soil Science Society of America Journal, Vol 44, No 4, p 797-802, July-August 1980. 7 Fig, 1 Tab, 14 Ref.

Descriptors: *Water table, *Soil moisture, *Computer models, *Evapotranspiration, Soil types, *Crop production, Unsaturated flow, Water level fluctuations, Grasses, Hydraulic conductivity, Root zone, Depth, Retention, Mapping, Soil survey data.

A one-dimensional computer model for simulating the soil moisture regime was used to calculate evapotranspiration and equivalent productions of grass for six different soils. Input data consisted of rooting depths, moisture retention curves, and hydraulic conductivity curves. Physical boundary conditions were derived from climatic data and depths to water table. Average relative production was calculated for actual water table fluctuations and for lowered levels, thus simulating the effects of groundwater extraction. Productions for the six soils reacted quite differently to lowering of the water table. A classification was developed to characterize the different reactions. A SYMAP computer program was used to produce maps (which were based on soil maps) showing the effects in different soils to lowering of the water table. Storage of basic data on tape allows the production of many maps on demand for natural conditions and for conditions changed by man. Soil survey interpretation thus becomes a matter of offering many choices rather than a qualitative judgment based on actual conditions. The model can be used to express variability of mapping units on a soil map by simulating moisture regimes for the range of soil properties observed within the mapping unit. (Visocky-ISWS)
W81-00101

2H. Lakes

THE ROLE OF ZOOPLANKTON VERTICAL MIGRATION IN STRUCTURING THE PHYTOPLANKTON COMMUNITY,
New Hampshire Univ., Durham. Dept. of Zoology.
J. F. Haney, and C. L. Buchanan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112633, Price codes: A05 in paper copy. Water Resource Research Center, University of New Hampshire, Research Report No 30, 1980. 84 p, 32 Fig, 13 Tab, 36 Ref. OWRT-A-044-NH (2), 14-31-0001-5029.

Descriptors: *Zooplankton, *Vertical migration, *Phytoplankton, *Regression analysis, *Distribution patterns, Aquatic animals, Model studies, Lakes, Community depth distribution, Model lake systems, Population depth control, Multiple regression analysis, *Daphnia, Arctic lakes, Light concentration, Food concentration.

Development of a model to predict the effectiveness of zooplankton grazing on phytoplankton requires knowledge of the factors which regulate the depth distribution of both communities. In this study, model lake systems (columns) were evaluated for their usefulness in the study of depth control of zooplankton populations. Simple linear regression and multiple regression analyses were employed to develop predictive models based on these studies under controlled laboratory conditions and in the field. Zooplankton depth regulation was further tested under continuous light in arctic lakes and ponds as well as in experimental columns. The influence of light and food concentration was examined with the experimental columns under controlled conditions. Food concentration strongly regulates the day-depth distribution of Daphnia populations. At high food densities the population mean depth approaches the surface waters and at low food levels the population is found in the deep water. This relationship was described by a linear regression equation. Vertical movements resulting from food changes were almost immediate, although differences were found between long-term and short-term responses. The relationship between temperature changes and population mean depth was also defined. Absolute light intensity was not an important regulator of day-depth and vertical migration in temperate or arctic zooplankton. However, the rate of evening migration in temperate zooplankton and the daytime displacement velocity of arctic zooplankton populations was closely correlated with the relative light change. Implications of these results to models of depth control and grazing by zooplankton are discussed.
W81-00021

HYDROLOGIC SETTING OF WILLIAMS LAKE, HUBBARD COUNTY, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
D. I. Siegel, and T. C. Winter.
Available from the OFSS, Box 25425, Fed. Ctr., Denver, CO 80225, $8.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-403, 1980. 56 p, 14 Fig, 6 Tab, 19 Ref.

Descriptors: *Hydrology, *Water balance, *Lakes, *Minnesota, *Model studies, Statistical methods, Glacial drift, Precipitation(Atmospheric), Evaporation, Groundwater, Surface waters, Discharge(Water), Flow characteristics, Water quality, Chemical analysis, Hydrographs, Data collections, *Williams Lake(MN), *Hubbard County(MN), *Surface-groundwater relationships.

The hydrology and geology of Williams Lake watershed was studied to evaluate the accuracy of various methods used to determine precipitation and evaporation in lake water-balance studies and to define a lake and ground-water system according to approaches suggested by theoretical modeling studies. Regression analysis between estimated and measured precipitation at the lake showed that the accuracy of regionalization techniques is dependent on the closeness of the data network to the lake. For individual storms, the average-value method was found to be better than either the weighted average or isohyetal methods of determining precipitation, but it was least accurate in estimating 14-day average precipitation. The amount of evaporation calculated by the mass-transfer method ranged from 2 to 7 inches per month from July to October 1978, depending on the method used to determine the mass-transfer coefficient. Test drilling indicated that 30 to 150 feet of sand and gravel overlies till in the Williams Lake watershed. A sand lens about 50 feet thick occurs within the till. The configuration of the water table and vertical-head gradients measured from July to December 1978 indicate that ground water moves into the lake from the south and east and moves from the lake into the ground-water reservoir to the west. Preliminary numerical models indicate that the sand lens within the till is effectively isolated from the flow system interacting with the lake and that both inseepage and outseepage were about 1.4 inches from mid-July to mid-October 1978. When estimated as a residual in a water balance, ground water showed a net outseepage only of 1.47 inches. (USGS)
W81-00050

THE EFFECTS OF USING GROUND WATER TO MAINTAIN WATER LEVELS OF CEDAR LAKE, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
R. S. McLeod.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-197593, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-23, April 1980. 35 p, 17 Fig, 4 Tab, 6 Ref.

Descriptors: *Lakes, *Water levels, *Effects, *Groundwater, *Wisconsin, Hydrogeology, Water level fluctuations, Flow characteristics, Aquifers, Seepage, Pumping, Recharge, Hydrologic budget, Water quality, Physical properties, Chemical analysis, Limnology, Cedar Lake(WI), Inflow, Water transfer.

Cedar Lake, a kettle lake with no surface inlet or outlet, was studied to evaluate the feasibility of maintaining water levels of lakes in the glaciated kettle moraine area of eastern Wisconsin by pumping ground water into them. A volume of water equivalent to that needed to raise the lake level 47 inches was pumped from the shallow aquifer system into Cedar Lake between February 1 and September 30, 1977. The water budget for the lake during this period indicated that approximately 90 percent of pumped water was either recycled from the lake to the well or otherwise lost as seepage from the lake. There were no identifiable changes in measured physical and chemical characteristics of lake water during the pumping period, nor were there identifiable changes in the number or makeup of the phytoplankton community. Differences in physical and chemical characteristics of lake water and ground water added to the lake probably were not great enough to cause changes within the lake. (USGS)
W81-00066

LIMNOLOGY OF LAGO LOIZA, PUERTO RICO,
Geological Survey, San Juan, PR. Water Resources Div.

For primary bibliographic entry see Field 5C.
W81-00067

ARCTIC INVESTIGATIONS OF SOME FACTORS THAT CONTROL THE VERTICAL DISTRIBUTIONS AND SWIMMING ACTIVITIES OF ZOOPLANKTON,
New Hampshire Univ., Durham. Dept. of Zoology.
C. L. Buchanan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118267, Price codes: A06 in paper copy, A01 in microfiche. Ph.D. Dissertation, 1978. 103 p, 26 Fig, 9 Tab, 73 Ref. OWRT-A-0440NHL1), 14-31-0001-5029.

Descriptors: *Zooplankton, *Vertical migration, *Phytoplankton, Distribution patterns, Aquatic animals, *Community depth distribution, *Population depth control, *Daphnia magna, Arctic lakes, Diel cycle.

The vertical distributions and movements of zooplankton populations in arctic lakes and ponds were studied. Plexiglas columns, which were surrounded on four sides by a light tight chamber and exposed to natural light from above, were used to study the vertical distributions and movements in closer detail and to measure zooplankton swimming rates. Populations did not undergo diel vertical migrations under continuous light or under long day photoperiods with dark nights. Extreme temperatures depressed the population mean depth, and diel temperature fluctuations could cause vertical movements in pond and column populations. A diel cycle was observed in the swimming rates of zooplankton populations exposed to both continuous light and long day photoperiods, with highest rates in the afternoon and sometimes in the morning. The cycle of swimming activity appears to be based in an endogenous rhythm, and could cause a slight vertical migration in zooplankton populations when phototactic orientation cues were weak. Zooplankton were transferred north and south to different light cycles to test the dependence of the diel cycle of swimming activity upon light. High or low temperatures changed the absolute rate of swimming activity but apparently did not affect the timing of the diel cycle. The behavior of a temperate species, D. magna, which was imported from New Hampshire, was similar to the behavior of species indigenous to the arctic. The association of zooplankton behavior with morphological and physiological features and the variation in vertical distribution caused by environmental and physiological factors are discussed in terms of the selective forces on vertical migrations.
W81-00084

DIEBACK ROLE OF MYRIOPHYLLUM SPICATUM IN MONROE RESERVOIR, INDIANA,
Indiana Univ. at Bloomington. Dept. of Biology.
D. H. Landers, and D. G. Frey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115685, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Center, Purdue University, West Lafayette, Indiana. Technical Report No 134, September 1980. 105 p, 23 Fig, 16 Tab, 70 Ref, 2 Append. OWRT-B-099-IND(1).

Descriptors: *Myriophyllum spicatum, *Ammonia, Nitrogen, *Dieback, Senescence, Cholorphyll, Phytoplankton, *Monroe Lake(IN), *Chemical reactions, *Lakes, *Limnology, *Seasonal, Nutrients, Phosphates, Nitrates.

Enclosures (2-m diameter) were placed in the littoral zone of Monroe Reservoir, Monroe Co., Indiana, to evaluate the chemical and biological effects of late summer dieback of Myriophyllum spicatum. Aerial photography, combined with quadrat sampling, was used to measure standing crop at peak summer biomass. Plant tissue analysis was applied to total biomass estimates to determine potential N and P release from senescing macrophytes. At the time of dieback, considerable pulses of Soluble Reactive Phosphorous (SRP), NH3-N and NO3-N were detected in the enclosures with plants and the adjacent open water sites. These nutrient inputs were associated with episodes of normal macrophyte senescence and decay. Chlorophyll a increased greatly in response to these nutrient inputs, indicating important increases in phytoplankton production as a direct consequence of macrophyte dieback. Crashing autumn phytoplankton populations were responsible for additional pulsed inputs of SRP, NH3-N and NO3-N in enclosed and open water locations. Realized nutrient inputs from senescent M. spicatum are estimated to represent as much as 20% of the annual P budget, and not more than 2.2% of the annual N budget for the reservoir.
W81-00085

AN ANNUAL BUDGET OF REDOX ACTIVE MATERIALS IN A LAKE,
Connecticut Univ., Storrs.
P. H. Rich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115644, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, August 15, 1980. 13 p, 3 Fig, 1 Tab, 2 Ref. OWRT-A-071-CONN(5).

Descriptors: *Oxidation-reduction potential, *Lakes, *Sediment-water interfaces, *Water quality, *Inorganic compounds, *Water chemistry, Lake sediments, Bottom sediments, Sediments, Mud-water interfaces, Ponds, Bodies of water, Sediment discharge, Peak discharge, Redox potential, Chemical reactions, Oxidation, Reduction(Chemical), Water properties, Carbon dioxide, Oxygen, Oxygen demand.

The objectives of this project covered (1) the determination of gross and net flux of iron, nitrogen, and sulfur compounds (redox-active) between interstitial water of surface sediments and the overlying lake water, through one annual cycle; (2) the determination of a synoptic material budget for the redox-active compounds in a small bog lake watershed; and (3) correlation of mineral activity in lake water and outflow stream with anaerobic benthic metabolism. It was noted that 50% more reducing power was generated as reduced alternate terminal electron acceptors in the lake (Durham Pond) as seen by reduction of oxygen to water; hence, areal hypolimnetic carbon dioxide increments better estimated total lake metabolism than areal hypolimnetic oxygen deficits. The watershed supplied more reducing power as dissolved organic matter than it supplied alternate electron acceptors on an annual basis. Finally, alternate electron acceptors were stored in oxidized form in surface sediments during circulation and high discharge periods, and used during both summer and winter stratification and low discharge. Hence, current input/output nutrient models accounted for a major biochemical energy transformation entraining redox-active elements and correlated within the lake ecosystem. (Zielinski-IPA)
W81-00092

CHANGES IN PHOSPHORUS CONCENTRATIONS DUE TO MIXING BY MOTORBOATS IN SHALLOW LAKES,
University of Central Florida, Orlando. Engineering and Industrial Experiment Station.
Y. A. Yousef, W. M. McLellon, and H. H. Zebuth.
Water Research, Vol 14, No 7, p 841-852, 1980. 9 Fig, 8 Tab, 22 Ref.

Descriptors: *Lakes, *Mixing, *Water quality, *Phosphorus, *Florida, Boats, On-site investigations, On-site tests, Turbidity, Data collections, Chlorophyll, Methodology, Nutrients, Water sampling, Dissolved oxygen, Propellers, Mechanical equipment, *Lake Claire(FL), *Lake Mizell(FL), *Lake Jessup(FL), Orthophosphorus, Organic carbon.

Recreational motorboats equipped with engines varying from 28 to 165 horsepower were operated at three selected Central Florida lakes. Also, a pair of isolation chambers representing aquatic habitats were placed in each lake for control and mixing studies. Mixing in isolation chambers was performed by small electrical motors connected to two blade propellers. Agitation of the water column in the lake mixing stations and inside the isolation chambers increased water turbidities and phosphorus concentrations. The increase in the orthophosphorus content for Lakes Claire, Mizell, and Jessup averaged 43, 16, and 73%, which corresponded to an average of 46, 24, and 105 mg-P of orthophosphorus resuspended per square meter of the bottom sediments, respectively. Similarly, the increase in the total phosphorus content for Lakes Claire, Mizell, and Jessup averaged 39, 28, and 55%, which corresponded to an average of 84, 58, and 249 mg-P/sq m, respectively. The increase in turbidity and phosphorus content occurred at a much higher rate than the rate of decline after cessation of mixing. The increase in phosphorus content could result in an increase in lake productivity as noticed from the increase of chlorophyll a concentrations in lake mixing stations. (Humphreys-ISWS)
W81-00100

PREDICTING FLUXES OF LATENT AND SENSIBLE HEAT OF LAKES FROM SURFACE WATER TEMPERATURES,
Florida Univ., Gainesville.
R. G. Bill, Jr., A. F. Cook, L. H. Allen, Jr., J. F. Bartholic, and T. Maki.
Journal of Geophysical Research, Vol 85, No C1, p 507-512, January 20, 1980. 5 Fig, 1 Tab, 14 Ref. OWRT A-031-FLA(3), 14-34-0001-8010.

Descriptors: *Heat flow, *Lakes, *Water temperature, On-site investigations, Measurement, Evaporation, Air temperature, Humidity, Winds, Instrumentation, Model studies, Mathematical models, Equations, Heat, Latent heat, Heat transfer, Correlation analysis, Meteorology, Limnology, Eddy correlation.

Wind velocity, air temperature, and humidity fluctuations were measured over Orange Lake, Florida, using an ultrasonic anemometer-thermometer and Lyman alpha humidity sensor. Latent and sensible heat fluxes were calculated from the data using the eddy correlation technique. Lake temperature at a 2.5-cm depth was measured in order to compare eddy correlation results with fluxes and the Bowen ratio predicted by the formulae of Hicks and Priestley and Taylor in which temperature is the sole parameter. Bowen ratio results were in good agreement with the formulations of Hicks and Priestley and Taylor if property values were evaluated at a temperature intermediate to the lake and 10-m air temperature. Disagreement with fluxes predicted by Hicks indicates that such formulations are inadequate for short-term flux evaluations under the meteorological conditions in which surface water temperature is changing with time. (See also W72-06439) (Sims-ISWS)
W81-00106

THE USE OF PERIODIC LIGHT APPLICATIONS OF ROTENONE AS A MANAGEMENT TECHNIQUE FOR SMALL IMPOUNDMENTS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
G. S. Libey, and L. E. Holland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118770, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No 132, September 1980, 39 p, 7 Fig, 7 Tab, 28 Ref. OWRT-A-054-IND(1).

Descriptors: *Fish management, *Rotenone, *Farm ponds, *Fish control agents, Pesticides, Bluegill, Bass, Balance of nature, Ecosystems.

A light (.1 ppm) application of rotenone was administered to two experimental ponds on June 26, 1979 in an effort to reduce larval bluegill survival through direct toxicity and by reduction of the food base (zooplankton) leading to starvation of the larvae. Zooplankton reductions caused by the toxicant could not be distinguished from natural fluctuations observed in the control pond. An average of .1 ppm concentration of rotenone caused noticeable increases in larval bluegill mortality without observed mortality or stress in bass or larger bluegill. A dosage of .07 ppm rotenone was observed to have minimal influence on larval bluegill numbers. An accurate, properly timed, light application of rotenone has potential as a useful and inexpensive (about $3) technique to

manage ponds with excessive prey (bluegill) production.
W81-00119

2J. Erosion and Sedimentation

CROSS-SECTION, VELOCITY, AND BED-LOAD DATA AT TWO EROSION SITES ON THE TANANA RIVER NEAR FAIRBANKS, ALASKA, 1979,
Geological Survey, Anchorage, AK. Water Resources Div.
R. L. Burrows.
Available from the OFSS, Box 25425, Fed. Ctr., Denver, CO 80225, $5.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-699, 1980. 32 p, 22 Fig, 4 Ref.

Descriptors: *Bed load, *Erosion, *Rivers, *Alaska, *Streamflow, Flow rates, Measurement, Sediment transport, Particle size, Sieve analysis, Hydraulics, Retaining walls, Hydrologic data, *Tanana River(AK), *Fairbanks area(AK).

In an effort to relate river processes to vertical and lateral erosion at two sites on the Tanana River in the vicinity of Fairbanks, Alaska, measurements of depth, velocity, and bedload-transport rates were made at several sections at each site. To facilitate comparison of the river processes and ongoing erosion, compilation and graphic presentation of the velocity distributions and bedload-transport rates are presented in conjunction with cross-section configuration immediately adjacent to the area of erosion. Dry sieve analyses of the bedload samples give particle-size distribution. Approximately 85 to 95% of the material in transport at both sites was in the sand range (>0.062 millimeter <2.0 millimeter). (USGS)
W81-00049

SEDIMENT-TRAP EFFICIENCY OF A MULTIPLE-PURPOSE IMPOUNDMENT, NORTH BRANCH ROCK CREEK BASIN, MONTGOMERY COUNTY, MARYLAND, 1968-76,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 4D.
W81-00060

2L. Estuaries

OCCURRENCE OF DAPHNIA PULEX IN LAKE ST. LUCIA,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Zoology.
S. J. M. Blaber, and N. Rayner.
South African Journal of Science, Vol 75, No 2, p 87, February 1979. 3 Ref.

Descriptors: *Daphnia, *Freshwater, *Estuarine environment, *Salinity, *Salt tolerance, Surface waters, Lakes, Plankton nets, Plankton, Daphnia pulex, South Africa, *Lake St. Luica(South Africa).

In August 1978, relatively large numbers of Daphnia pulex (Cladocera) were captured in South Lake St. Lucia, South Africa. They were captured during routine monthly plankton sampling in surface waters of 11% salinity, with no layering, and a temperature of 21 degrees C. Clarke-Bumpus nets were used. They were fitted with a flow-meter and 70 micrometer mesh net and a 'D' net (crossbar of 30 cm and an arch of 19 cm maximum height) also fitted with a 70 micrometer mesh net. None was captured in the 'D' net. D. Pulex is a freshwater group and their appearance in an estuarine system is significant. It is believed that they could have entered the system from the Mkuze River, 30 km to the north allowing a gradual acclimatization to saline water as a horizontal salinity gradient exists from north to south at St. Lucia. Because D. pulex has a freshwater distribution, little is known of its salinity tolerance. Its upper tolerance limit to magnesium chloride is 0.12 g/l, its tolerance of sodium being somewhat greater. (Stiles-IPA)
W81-00039

FRESHWATER RESOURCES OF BIG PINE KEY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. E. Hanson.
Available from OFSS, Box 25425, Fed. Ctr., Denver, CO. 80225, Paper copy $5.00, Microfiche $3.50. Geological Survey Open-File Report 80-447, 1980. 36 p, 15 Fig, 6 Tab, 5 Ref.

Descriptors: *Freshwater, *Groundwater resources, *Available water, Aquifer characteristics, Water quality, Saline water intrusion, Tidal effects, Water level fluctuations, Rainfall, Pumping, Water wells, Water analysis, Potable water, Potential water supply, Planning, Hydrographs, Data collections, Freshwater lens, *Big Pine Key(FL), Saline water-freshwater interfaces.

The principal freshwater-bearing unit underlying Big Pine Key, Fla, is a layer of oolitic limestone averaging 19 feet in thickness. The freshwater exists in two separate lenses, one in the northern half of the island and one in the southern half. The slightly larger north lens is separated from the south lens by a low-lying land area 1 to 3 feet above mean sea level. The lenses float on saltwater in the aquifer and are affected by tidal fluctuations. The areal and depth configuration of the lenses fluctuate in response to rainfall, evapotranspiration, lateral and vertical losses, and pumpage from local wells. The lenses are not a major source of freshwater. Only a small amount of the freshwater in the lenses can be removed before saltwater intrusion will occur. (USGS)
W81-00069

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

RESEARCH AND DEVELOPMENT ON A SPIRAL-WOUND MEMBRANE SYSTEM FOR SINGLE-STAGE SEAWATER DESALINATION,
UOP Inc., San Diego, CA. Fluid Systems Div.
R. L. Riley, and C. E. Milstead.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-105918, Price codes: A10 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, August 1977, 207 p, 52 Fig, 63 Tab, 14 Ref. OWRT (No 6516) (1), 14-34-0001-6516.

Descriptors: *Membranes, *Reverse Osmosis, *Desalination, *Sea water, *Spiral-Wound Elements, Separation techniques, Desalination processes, Desalination apparatus, Research and development.

Spiral-wound thin-film composite membrane systems have been developed for seawater desalination by reverse osmosis. Among the most promising membranes developed are a family of aromatic poly (ether/amides) and poly)ether/ureas). These membranes exhibit outstanding transport, mechanical, thermal, biological, and chemical properties. The major effort during the program focused on the poly (ether/amide) thin-film composite membrane, designated PA-300. Membrane fabrication optimization studies resulted in the scale up of the process from 14-in. to 38-in. wide membrane produced on a continuous basis. Characterization studies under various operating conditions were conducted. For single-pass seawater desalination, stable water fluxes of 9.0 gal/ft super 2-day and sodium chloride rejections of greater than 99% were attained with two- and four-in. diam. PA-300 membrane elements at an applied pressure of 650 psi in pilot plant tests at Sea World Marine Park in San Diego, CA. Water fluxes of 10-13 gal/ft super 2-day and rejections of 98-99% were attained with 30-45% water recovery at an applied pressure of 800 psi with four- and six-in. diam. PA-300 membrane elements in two-stage seawater desalination pilot tests at Wrightsville Beach, NC. The establishment of large-scale continuous membrane production, combined with excellent seawater performance of spiral-wound elements demonstrates a significant advance toward the commerical application of thin-film composite membranes.
W81-00001

DEVELOPMENT OF A CHLORINE-RESISTANT COMPOSITE MEMBRANE FOR REVERSE OSMOSIS,
Envirogenics Systems Co., El Monte, CA.
A. F. Graefe, and D. Wong.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115420, Price codes: A03 in paper copy, A01 in microfiche. Final Report No 2001-20 to Office of Water Research and Technology, August 1980, 40 p, 4 Ref. OWRT-C-80 298-5 (No 8529)(1), 14-34-0001-8529.

Descriptors: *Reverse osmosis, *Membrane, Composite, *Seawater, Brackish water, *Desalination, Polysulfone, Sulfonated polysulfone, Lactic acid, Non-Cellulosic.

The objective of this program was to develop chlorine-resistant non-cellulosic composite desalination membranes that would exhibit a minimum flux of 10 gfd at greater than 99% salt rejection when tested with synthetic seawater at 1000 psi, and/or a minimum flux of 15 gfd at greater than 90% salt rejection when tested with 5000 ppm sodium chloride at 250 psi. The membrane selected for this purpose consisted of a sulfonated polysulfone barrier layer overlaid on the surface of unmodified microporous polysulfone as a support. In work involving sulfonated polysulfone dense films, a study was conducted in which various cloth-backed polysulfone supports were pretreated with aqueous lactic acid, followed by brushing with 0.5% sulfonated polysulfone in 2-methoxyethanol. The purpose of the lactic acid was to prevent intrusion of sulfonated polysulfone into the support pores. The best membrane specimen exhibited a water flux of 32.3 gfd at 94.5% salt rejection when tested with 0.5% sodium chloride at 250 psi. These data exceeded the program performance goal set for brackish water. Another membrane showed 11.3 gfd at 90.1% salt rejection when tested under the same conditions. However, several attempts to reproduce these results were unsuccessful. Several sulfonated polysulfone composite membranes containing asymmetric barrier layers were fabricated by brush-coating microporous polysulfone supports with sulfonated polysulfone in 2-methoxyethanol, followed by gelation in water at 1C. Salt rejection values for these membranes, when tested under brackish water conditions, was limited to about 90%.
W81-00002

DESIGN STUDY OF THE VTE BOILER CYCLE FOR THE DESALINATION OF SEA WATER VOLUME 1. MAIN REPORT AND APPENDIX A,
Envirogenics Systems Co., El Monte, CA.
I. Kamal.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113151, Price codes: A10 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, January 1980. 180 p. OWRT-C-80277-S(No 8565)(1), 14-34-0001-8565.

Descriptors: *Desalination, *Sea water, *Desalination apparatus, *Design, *Cost comparisons, Efficiencies, Evaluation, Boilers, Heat transfer, Computer programs, *VTE boiler.

Flow sheets have been developed for the VTE boiler cycle, which is a dual-purpose power/desalination system. Computer programs have been written and used to calculate equivalent performance ratios and process data for the VTE boiler and the conventional dual-purpose plant with both extraction and back-pressure schemes of steam supply to the evaporator. High EPRs are obtained for the VTE boiler when (a) the heating steam is withdrawn from the turbine at a low pressure, (b) the secondary turbine is designed for high efficiency, (c) the number of effects in the VTE boiler is small and (d) the temperature driving potential is small. The thermal loss to the power cycle is low, with the VTE boiler acting like a moisture separator returning dry, steam to the turbine cycle at condi-

tions close to those under which the steam was withdrawn. Cost studies have been carried out for the VTE boiler and the conventional system for 50 MWe/1 mgd. The studies show that the energy requirement of the VTE boiler is less than half that of the conventional plant when both are designed for optimum performance. Further work on the development of economical and efficient low-pressure turbines is necessary in order to realize the potential of the VTE boiler.
W81-00071

A PROCESS DESIGN OF A 60,000 GALLON PER DAY VACUUM FREEZING EJECTOR ABSORPTION PILOT PLANT,
Chicago Bridge and Iron Co., IL.
V. F. Allo, G. E. Engdahl, J. A. Nail, T. J. Nowak, and D. C. Stafford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-114688, Price codes: A07 in paper copy, A01 in microfiche. Final Report to U. S. Department of the Interior, Office of Water Research and Technology, July, 1980. 118 p, 2 Append. OWRT-C-90058-D(No 9512)(2), 14-34-0001-9512.

Descriptors: *Desalination plants, *Design specifications, *Pilot plants, *Desalination processes, Design, Freezing, Engineering, Construction, Hydrologic aspects, Design data, Design standards, Heat balance, Design criteria, Crystallization, Water purification, Facilities.

A conceptual design study was completed of the vacuum freezing ejector absorption (VFEA) process, a freeze desalination process in which water vapor from a vacuum freezer is compressed by combined action of a streamjet ejector and an absorption refrigerator. The development program was intended to prove technical and economic feasibility of this process. The report includes design specifications for a 60,000 gallons per day pilot plant, complete with detailed equipment specifications and engineering drawings. Construction of a VFEA pilot plant and advancement of the VFEA process through the pilot and demonstration phases was recommended on the basis of indicated lower water costs for the VFEA process. The VFEA process retains the intrinsic advantages of freezing processes of having no pretreatment, negligible scaling and fouling, and minimal corrosion. However, the VFEA process utilizes low grade thermal energy more efficiently than any existing desalination process. The projected power costs for the VFEA process were forecasted to be less than those attainable in the foreseeable future by any distillation or membrane plant in seawater desalting service. A VFEA computer program model was designed for steady state plant mass and heat balance to simulate effects of saline feed factors on plant performance. (Zielinski-IPA)
W81-00077

RESEARCH ON OXYGEN IN THE FEED WATER TO A REVERSE OSMOSIS PILOT PLANT AT THE WRIGHTSVILLE BEACH TEST FACILITY,
Office of Water Research and Technology, Washington, DC.
R. S. Robinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113219, Price codes: A06 in paper copy, A01 in microfiche. Final Report (1980), 84 p, 4 Fig.

Descriptors: *Desalination, *Reverse osmosis, *Feedwater pretreatment, Flux enhancement, *Pilot plants, Desalination processes, *Oxygen, Sea water, Temperature, Wrightsville Beach(NC).

An evaluation was made on the influence of dissolved and undissolved oxygen (O2) in the feed water to a spiral wound seawater reverse osmosis (R.O.) pilot plant. A series of tests were conducted with O2 either added to or deaerated from the seawater. Use of additives to improve salt rejection also was evaluated. Changes in ambient temperature flux and salt rejection performance of the R.O. elements were determined as a function of O2 addition or deletion from feedwater.
W81-00080

WATER STORAGE CONTROL FOR REVERSE OSMOSIS SYSTEM,
Desalination Systems, Inc., Escondido, CA. (Assignee).
R. A. Tondreau, and D. T. Bray.
U.S. Patent No 4,190,537, 6 p, 4 Fig, 4 Ref. Official Gazette of the United States Patent Office, Vol 991, No 4, p 1370-1371, February 26, 1980.

Descriptors: *Patents, *Desalination, *Water treatment, Reverse osmosis, Membrane processes, Separation techniques, Semipermeable membranes, Desalination apparatus.

A reverse osmosis system employs a tank for storing permeate under a pressure which is a portion of the pressure of feed water introduced into a pressure resistant container housing a semipermeable membrane cartridge. Control means such as an automatic valve, preferably of the double diaphragm type, in the line introducing feed water closes to shut off feed water flow when the pressure in the permeate storage tank reaches a first predetermined value, less than the feed water pressure, and re-opens to re-establish feed water flow at a second predetermined pressure lower than the first or shut-off pressure. A constricted passageway device such as a venturi in the pipe or connection between a dispensing device such as a faucet and the permeate storage tank has its throat communicating with the sensing conduit for actuating the feed water control valve. When the dispensing faucet is opened, flow of permeate through the venturi creates an amplified and drastically reduced pressure in the sensing conduit, and applies a servo or magnified actuation force to the valve in the re-open end of its control range. (Sinha-OEIS)
W81-00133

EVALUATION OF TECHNICAL MATERIAL AND INFORMATION FOR SEAWATER DESALTING DEMONSTRATION PLANTS.
Boyle Engineering Corp., San Diego, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118804, Price codes: A08 in paper copy, A01 in microfiche. Completion Report prepared for Office of Water Research and Technology, August, 1980. 81 p, 38 Ref, 6 Append. OWRT-C-00183-D(No 0453)(1).

Descriptors: *Desalination plants, *Reverse osmosis, *Sea water, *Water shortage, *Evaluation, *Water purification, *Sites, Saline water, Oceans, Salinity, Saline water conversion, Desalination processes, Water supply, Salt extraction, Water desalting, Appraisals, Demineralization, Separation techniques, Osmosis, Potable water, Islands.

Evaluation was conducted of technical information/material provided by applicants to the OWRT Desalting Demonstration Plant Program, authorized by P.L. 95-84 and 95-467 to demonstrate state-of-the-art in desalting technology. The evaluation used eight criteria: interest and commitment; and considerations for general site, desalting needs, demographics and socio-economics, water supply, financial, energy, and environmental. Twenty sites located in thirteen states, the Mariana Islands, and the Virgin Islands were evaluated under these criteria. The sites were ranked by raw cumulative score. Sites with critical water needs were identified in both small and large cities. Comments were provided on the top ten ranked sites. The top ranked site to demonstrate single-stage reverse osmosis (RO) desalination was Grand Isle, Louisiana. The second ranked site was Key West, Florida, partly since its water shortage has become more acute than two years ago. It was determined that all twenty site applications were justified for consideration in the seawater RO demonstration plant program and that more than half would have been excellent demonstration plant sites, but critical water shortage of the two top ranked sites and other qualifications mandated their high rankings. (Zielinski-IPA)
W81-00199

DEVELOPMENT OF COMPOSITE HOLLOW FIBERS,
Bend Research, Inc., OR.
R. W. Baker, R. P. Barss, and H. K. Lonsdale.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119554, Price codes: A03 in paper copy, A01 in microfiche. Final Report of Phase I, March 1980, 40 p, 19 Fig, 7 Tab, 10 Ref. OWRT-S-0017(No 7552)(1), 14-34-0001-7552.

Descriptors: *Reverse osmosis, *Desalination, Hollow fibers, Fiber spinning, Composite membrane.

The objective of this program is to demonstrate the feasibility of using inside-skinned composite hollow fibers for brackish water desalination via reverse osmosis. Composite hollow fibers potted in modules with tube-side feed should be more resistant to fouling and less expensive than current module designs, partly because expensive pretreatment of the feed is unnecessary and partly because the fibers are self-supporting and do not require expensive pressure-containment vessels. The performance of these fibers compares favorably with current cellulose acetate brackish water membranes, and is superior to commercial brackish water hollow fiber systems. (Rykken-Bend)
W81-00200

MULTI-STAGE FLASH DISTILLATION PROCESSES,
Technische Hogeschool, Delft (Netherlands)
A. W. Veenman
Effluent and Water Treatment Journal, Vol 20, No 8, p 371-375, 377, August, 1980. 9 Fig, 1 Tab, 11 Ref.

Descriptors: *Desalination, *Flash distillation, Heat exchangers, *Operating costs, *Pilot plants, Desalination apparatus, Desalination processes, Distillation, Long-tube vertical distillation, Scaling, Evaporators, Condensers, Multi-stage flash distillation.

A new system for desalination of ocean water is described. It is based on multi-stage flash distillation technology which is presently the dominant conventional method. In the new system, costs of energy consumption are reduced. Less specific heat is required for evaporation, the fouling factor of the heat exchanger is reduced, and the product output per volume is increased. The new system combines a vertical evaporator with a fluidized bed heat exchanger in one integrated column. Evaporation takes place in a vertical series of chambers each at a reduced saturation pressure. Condensation occurs simultaneously with the transfer of heat to feedwater in the heat exchanger. This is achieved in parallel condenser tubes partially filled with solid particles in a fluidized state. The system has been in operation for three years in pilot plants in the Netherlands. (Titus-FRC)
W81-00228

3B. Water Yield Improvement

EXPANSION VERSUS CONSERVATION OF WATER SUPPLY,
Library of Congress, Washington, DC.
W. Viessman.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH. p 117-121, 1979. 4 Ref.

Descriptors: *Water supply development, *Water conservation, *Water resources development, *Water supply, Planning, Drought, Water shortage, Forecasting, Water policy, Water costs, Environmental effects, Alternate planning, Economic feasibility, Water resources.

Despite the current emphasis on water conservation practices, there is a need for new water supply development. Conservation will not solve all of our water problems. Even with maximum conservation the water saved would soon be assimilated in new growth especially in water-short rapid growth areas such as the Southwest. Also, there are risks associated with the conservation approach to water management. In the past many areas survived droughts because there was room to con-

serve, but with maximum conservation already in place during normal times there is no margin of safety for times of drought. Uncertainty about the effectiveness of many water conservation measures also puts more emphasis on continued water supply development. The economics of conservation should also be considered. The encouragement of conservation practices beyond economically and environmentally feasible limits is questionable. Many social and institutional barriers to conservation still exist. It is often difficult to get people to accept and use the available technology. Conservation shoul be used as an option, where effective, in water supply planning but it does not eliminate the need for additional water supply development. (See also W81-00160) (Seigler-IPA)
W81-00173

HIGH PLAINS DROUGHT: LESSONS AND PLANNING,
Texas Dept. of Water Resources, Austin.
H. W. Grubb, M. L. Wright, G. W. Bomar, and C. A. Tuck.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 218-227, 1979. 3 Tab, 6 Ref.

Descriptors: *Great Plains, *High Plains, *Droughts, Irrigation water, Planning, Forecasting, Legislation, Rain-enhancement, Water reuse, Water policy, Agriculture, Semiarid climates, Water supply, Groundwater, Water shortage.

The Great Plains Region, an area of important food grains, fiber, feed grains, and beef production, is subject to periodic extended droughts which have a major economic effect on the local, regional, and national economies. The area has extensively developed irrigation using exhaustible groundwater reserves to produce from 2.5 to 4.0 times the crop yields expected from dryland acres. This irrigation also stabilizes annual income and produces a larger supply of food and fiber materials for national and export markets. Repeated droughts in the area clearly illustrate the need for more reliable long-range weather forecasting techniques and expanded development of supplemental water supplies. More accurate forecasting is difficult due to the extreme variability in time and space of drought on the Great Plains. While conservation is frequently proposed as an alternative to development, increasing the water supply will reduce economic effects. Two potential major water supply management techniques for the area are reuse and rain-enhancement. Legislative actions have been taken to study ways of planning for supplemental water supplies. A study is now underway to: (1) protect the Nation's continued food supply, (2) promote the economic vitality of the region, and (3) evaluate alternative development strategies. (See also W81-00160) (Seigler-IPA)
W81-00187

3C. Use Of Water Of Impaired Quality

AN ECONOMIC EVALUATION OF GREENBELT IRRIGATION WITH EFFULENT WATER,
California Univ., Riverside. Dept. of Botany and Plant Sciences.
W. W. Wood, V. B. Younger, G. B. Benoit, and D. R. Hurd.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112666, Price codes: A04 in paper copy. California Water Resources Center, University of California, Davis Technical Completion Report, September 1980, 72 p, 8 Tab, 2 Append. (California Water Resources Center Project UCAL-WRC-W-532). OWRT-A-065-CAL (1).

Descriptors: *Wastewater disposal, *Effluents, *Irrigation, *Economics, *Energy, Costs, Reclaimed water, Water reuse, California, Maloney Canyon Project(CA).

Land disposal of wastewater, although not a new concept, has received widespread interest in recent years because of an increased need to conserve water and a greater public concern about water pollution. While there have been numberous recent research projects on the use of wastewater for irrigation, very few have dealt specifically with the economic aspects. The maloney Canyon Project in California has shwon that greenbelt irrigation with wastewater is feasible from the biological and physical standpoints. Based on the above project, this research attempted to quantify the specific monetary and energy costs associated with land application renovation of wastewater, and to a lesser extent consider the long-run implications. In the first half of this study the attempt was made to see whether land application compares favorably with other forms of advanced wastewater treatment. Relationships between the fundamental characteristics of plant types such as capacity, treatment unit type, capital cost, etc., were studied by using statistical analysis such as linear regression, crosstabulations, and factor analysis. The last objective of this paper was to estimate the fixed, variable, and total cost functions of applying water through greenbelt irrigation as those functions vary relative to capacity, design, and geography. (Snyder-CA).
W81-00025

EFFECTS OF SPRAY IRRIGATION OF MUNICIPAL WASTEWATER ON TRACE METALS IN SEVERAL CROP AND FOREST ECOSYSTEMS,
Pennsylvania State Univ., University Park. School of Forest Resources.
W. E. Sopper, and S. N. Kerr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-114001, Price codes: A04 in paper copy, A01 in microfiche. Institute for Research on Land and Water Resources, The Pennsylvania State University, Research Project Technical Completion Report, Sept. 1980, 30 p, 15 Tab, 7 Ref. OWRT-B-083-PA (2), 14-31-0001-5109.

Descriptors: *Irrigation effects, *Municipal wastes, *Impaired water use, *Crop response, *Forestry, Water reuse, Water quality, Waste water, Soil analysis, Treated municipal waste water, Trace metals, Forest ecosystem, Tree growth, Soil samples, Vegetation samples, Foliar samples, Waste water quality, Agronomic crops.

Since 1963 secondary treated municipal wastewater has been spray-irrigated on crops and forestland at various application rates at The Pennyslvania State University. In general, results have indicated that the wastewater applications have been beneficial in terms of increasing crop yield and tree growth and that the wastewater can be satisfactorily renovated for groundwater recharge. In 1975, soil and vegetation samples were collected from all control and irrigated plots for trace metal analysis. The highest applications of wastewater was at a rate of 5 cm per week. At this rate approximately 18.8 m of wastewater were applied during the period 1963 to 1975. Soil samples were collected at the 0-5, 5-10, 10-15 and 15-30 cm depths. Foliar samples were collected from the agronomic crops and from the trees and subordinate vegetation in the forest stands in both the irrigated and control areas. Soil and vegetation samples were analyzed for copper, zinc, chromium, lead, cobalt, cadmium, and nickel. It can be concluded from the data collected that wastewater irrigation at The Pennsylvania State University Farms did not significantly increase the trace metal concentrations in the soil or vegetation after 13 years of application.
W81-00041

MUNICIPAL SEWAGE EFFLUENT APPLICATION TO SOILS BEARING HARDWOOD COPPICE AND LOBLOLLY PINE STANDS,
Clemson Univ., SC. Dept. of Forestry.
C. L. Lane, N. R. Page, B. R. Smith, A. T. Shearin, and R. O. Hegg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113987, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Institute, Clemson University Report No 85, 1980, 17 p, 2 Fig, 5 Tab, 100 Ref. OWRT-B-096-SC (1).

Descriptors: *Sewage effluents, *Forest soils, Piedmont soils, Wastewater, Loblolly pine trees, Hardwood, Coppice, Tree growth, *Irrigation effects, *Water reuse, *Effluent renovation, Forestry, Spray irrigation.

Treated municipal sewage effluent was spray irrigated on an area adjacent to the sewage treatment plant of the Town of Clemson, SC. A hardwood coppice and a 35-year-old loblolly pine plantation were irrigated with weekly treatments for two years. These treatments were zero, 2.5 cm, 5 cm and a variable rate that during the growing season was 11.5 cm equivalent irrigation per week. Two-year biomass production on the coppice stand was proportional to treatment rates being 5030 kg/ha, 6500 kg/ha, 7700 kg/ha, and 9700 kg/ha dry weight, respectively. Height growth of the pines was 183 cm, 189 cm, 219 cm, and 261 cm. Diameter growth of the pines was one cm for all treatments. Soil analysis for fecal coliforms showed that by the time the effluent reached 45 cm, they had been effectively removed. There was no evidence of any groundwater or adjacent stream contamination at the rates applied.
W81-00043

THE PRODUCTION OF AGRICULTURALLY USEFUL MUTANT PLANTS WITH CHARACTERISTICS CONDUCIVE TO SALT TOLERANCE AND EFFICIENT WATER UTILIZATION,
Colorado State Univ., Fort Collins. Dept. of Botany and Plant Pathology.
M. W. Nabors.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-114712, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, October 1979. 35 p, 2 Fig, 1 Tab, 22 Ref, 5 Append. Colorado Water Resources Research Institute, Colorado State University. OWRT-C-7017 (no 6232)(1), 14-34-0001-6232.

Descriptors: *Salt tolerance, *Saline soils, *Plant growth, *Greenhouses, Growth chambers, Salinity tolerance, Resistance, Salts, Sodium compounds, *Agriculture, Wheat, Corn(Field), Oats, Tobacco, Tomatoes, Vegetable crops, Cultures, Colorado.

The current estimate of $16 million for annual damage from excess salinity in the Colorado basins is expected to reach $51 million by the year 2010. Feasibility for utilizing new varieties of plants designed for compatibility with excess salinity was investigated. The report demonstrates that available tissue culture methodology can be used to rapidly select NaCl-tolerant cell lines and to regenerate whole plants from these lines. The regenerated plants were shown to be salt-tolerant in greenhouse experiments, and were found capable of passing this tolerance onto two generations of offspring. It thus appears that salt tolerance, which can be economically selected in tissue culture, is both persistent and inheritable in regenerated plants. Salt-tolerant cell lines were selected in wheat, oats, and tobacco, and salt-tolerant plants were regenerated from these three cell line species. Greenhouse testing was nearly complete for tobacco, and was underway for oats. The goal of increasing arid land food production may be best achieved by producing compatible plant varieties. In addition, considerable advancement in tissue culture methodology was achieved for sugarbeets, tomatoes, and corn, and mutation selection could begin now in tomatoes and within a year in corn and sugarbeets. (Zielinski-IPA)
W81-00076

THE UTILIZATION OF TREATED MUNICIPAL WASTEWATER FOR CROP PRODUCTION IN BUCKEYE, ARIZONA,
Arizona Univ., Tucson. Dept. of Plant Sciences.
J. A. McFadyen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115214, Price codes: A04 in paper copy, A01 in microfiche. M.S. Thesis, 1976. 44 p, 15 Tab, 35 Ref. OWRT A-050-ARIZ(3), 14-31-0001-5003.

Descriptors: *Irrigation effects, Irrigation practices, *Wastewater reuse, Municipal wastes, Water conservation, *Crop response, Water reuse, *Crop production, Arizona, Wheat, Barley, Alfalfa, Soil properties, Pump water-waste water mixture.

Production of selected crops irrigated with treated municipal wastewater and pump water mixtures and with pump water alone was investigated. Wheat and barley irrigated with wastewater-pump water mixtures produced higher grain yields than did wheat and barley irrigated only with pump water. Alfalfa hay yields were higher for fields irrigated with wastewater-pump water mixtures than for fields irrigated with pump water alone. No differences were noted between irrigation treatments for safflower seed yields or for lint cotton yields. The pump water alone irrigated fields were fertilized by grower applications and by nutrients in the irrigation water with more nitrogen but less phosphorus than the wastewater-pump water mixture irrigated fields. Soils irrigated with wastewater-pump water mixtures had higher levels of extractable phosphorus than did soils irrigated with pump water alone. Pump water had higher concentrations of soluble salts and nitrate-nitrogen than did the wastewater-pump water mixtures; however, the wastewater-pump water mixtures contained higher levels of phosphorus than did pump water. Treated municipal wastewater can be utilized effectively as a source of plant nutrients and irrigation water in the commercial production of field crops in the southwestern United States.
W81-00086

WASTEWATER HELPS THE BARLEY GROW,
Arizona Univ., Tucson. Dept. of Plant Sciences.
A. D. Day, J. A. McFadyen, T. C. Tucker, and C. B. Cluff.
Water & Wastes Engineering, August 1979, p 26-28. OWRT-A-050-ARIZ(2), 14-31-0001-5003.

Descriptors: *Irrigation effects, *Waste water, *Barley, Growth rates, Experimental farms, Grains(Crops), Arizona, Pump water-wastewater mixture, Soil properties.

Experiments were conducted in southern Arizona to investigate the effects of irrigation with pump water and a pump water-wastewater mixture on barley (Hordium vulgare L.) growth, grain yield, and grain quality; soil properties; and irrigation water quality. In 1974 and 1975, on small plot research, barley irrigated with a 50:50 mixture of pump water and wastewater significantly exceeded barley irrigated with pump water alone in plant height, number of heads per unit area, number of seeds per head, seed weight, grain yield, and straw yield. In large field studies conducted from 1970 through 1977, barley irrigated with the mixture had taller plants, more lodging, lower grain volume-weights and higher grain yields than barley irrigated with pump water alone. Soils irrigated with both types of irrigation water had similar pH. Soluble salts (ECx10(3)), exchangeable sodium percentage, nitrate-nitrogen, and extractable phosphorus were significantly higher in soils irrigated with the pump water-wastewater mixture than in soils irrigated with pump water. Water quality analyses showed that the pump water-wastewater mixture had lower total soluble salts, lower nitrate-nitrogen, and higher phosphorus levels than pump water alone.
W81-00097

COMMERCIAL PRODUCTION OF WHEAT GRAIN IRRIGATED WITH MUNICIPAL WASTE WATER AND PUMP WATER,
Arizona Univ., Tucson. Dept. of Plant Sciences.
A. D. Day, J. A. McFadyen, T. C. Tucker, and C. B. Cluff.
Journal of Environmental Quality, Vol 8, No 3, p 403-406, July-Sept. 1979. OWRT-A-050-ARIZ(1), 14-31-0001-5003.

Descriptors: *Irrigation effects, *Municipal wastes, *Waste water, *Wheat, Growth rates, Experimental farms, Grains(Crops), Arizona, Soil properties, Pump water-wastewater mixture.

Experiments were conducted in southern Arizona to study the effects of irrigating wheat (Triticum aestivum L.) with a mixture of pump water and waste water and with pump water alone on wheat growth, grain yield, grain quality, soil properties, and irrigation water quality. In small plot research, wheat irrigated with the pump water-waste water mixture produced taller plants, more heads per unit area, heavier seeds, higher grain yields and higher straw yields than did wheat grown with only pump water. When large fields were compared, wheat grown with the pump wastewater mixture had taller plants, more lodging, lower grain volume-weights, and higher grain yields than did wheat produced with pump water. The pH and exchangeable sodium of soil irrigated with pump water alone or the pump water-waste water mixture were similar. Soluble salts and nitrate-nitrogen were higher in soils irrigated with pump water than they were in soils irrigated with the pump water-waste water mixture. Extractable phosphorus was higher in soils irrigated with the pump water-waste water mixture than in soils irrigated with pump water. Total soluble salts and nitrate-nitrogen were higher in pump water than they were in the pump water-waste water mixture; however, the pump water-waste water mixture had higher levels of total nitrogen and phosphorus than did pump water. The higher grain yields obtained when wheat was irrigated with the pump water-waste water mixture than were produced when wheat was grown with pump water alone probably resulted from lower concentrations of soluble salts in the pump water-waste water mixture than were present in pump water.
W81-00098

HYDROGEOLOGIC DATA FOR THE MCKAY CREEK SUBSURFACE WASTE-INJECTION TEST SITE, PINELLAS COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. J. Hickey.
Geological Survey Open-File Report 77-802, November 1977. 94 p, 17 Fig, 32 Tab, 18 Ref.

Descriptors: *Hydrologic data, *Injection wells, *Waste disposal wells, *Baseline studies, Water quality, Hydrologic properties, Underground storage, Effluents, Path of pollutants, Test wells, Water levels, Water analysis, Hydrogeology, Florida, Pinellas County(FL).

Lithologic, hydraulic, geophysical, and water-quality data collected at the McKay Creek subsurface waste-injection test site in Pinellas County, Florida, are reported. Data were collected to determine the possibility of subsurface injection of waste-treatment plant effluent. One exploratory hole, one test injection well, and eight observation wells were constructed between May 1973 and February 1976. The exploratory hole was drilled to a depth of 1,750 feet below land surface; the test injection well is open in dolomite between 952 and 1,040 feet; and the observation wells are open to intervals above, in, and below the test injection zone. The lithology of the upper 100 feet is predominantly clay. From 100 to 1,750 feet below land surface, limestone and dolomite predominate. Gypsum is present 1,210 feet below land surface. Laboratory analyses of cores taken during drilling are given for vertical intrinsic permeability, porosity, interval transit time, and compressibility. Specific capacities tested during drilling range from 4 to 2,500 gallons per minute per foot of drawdown. An 83-hour withdrawal test at 4,180 gallons per minute and a 2-month injection test at 650 gallons per minute were run. Small water-quality changes were observed in one observation well immediately above the test injection zone during and after the injection test. Formation water in all of the wells with the exception of the shallowest observation wells is saline. The vertical position of saltwater is estimated to be at about 280 feet below land surface. Thirteen wells within a 1-mile radius of the test site were located and sampled for water quality. (USGS)
W81-00152

3D. Conservation In Domestic and Municipal Use

PROCEEDINGS OF THE CONFERENCE ON WATER CONSERVATION NEEDS AND IMPLEMENTING STRATEGIES,
Conference held July 9-13, 1979, at Franklin Pierce College, Rindge, NH, American Society of Civil Engineers, New York, NY, 1979. 276p

Descriptors: *Droughts, *Planning, Water shortage, Water policy, Risks, Water demand, Water supply, Mathematical models, Streamflow forecasting, Reservoirs, California, Water rates, Legislation, Water management(Applied), Hydrology, Urbanization.

Twenty-nine papers discussing the evidence available to recommend water conservation and to identify the studies still needed were presented by scientists and engineers at the conference. Three major facets of water conservation discussed were: (1) the role and degree of effectiveness of legislative, administrative, legal, and political science forces; (2) the technical, engineering, and scientific methods available; and (3) the financial and economic means available to influence water conservation. The conferene concluded that President Carter's basic policy on water conservation is theoretically sound, however, several of its components need clarification. Legislative and executive action should be designed to assure that conservation is one of several alternatives considered and it should not discourage structural approaches when they are the most efficient alternative. No nationally applicable statement can be made about the technical effectiveness and impact of water conservation measures. Individual site-specific studies will be needed to draw effectiveness conclusions. Also, conservation measures, while saving water, may not be cost effective depending on the specific situation. Allocation of the costs of water conservation among beneficiaries will be necessary as conservation for conservation's sake could have serious economic consequences. (See W81-00161 thru W81-00189). (Seigler-IPA)
W81-00160

WATER CONSERVATION: THE FEDERAL VIEWPOINT,
Water Resources Council, Washington, DC.
L. M. Eisel.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979. Franklin Pierce College, Rindge, NH, p 22-27, 1979.

Descriptors: *Water conservation, *Water policy, *Federal government, *Planning, Legislation, Water resources development, Water supply, Environmental effects, Federal-State water rights conflicts, Water rights, Grants, Government finance, Water costs, Water demand, Programs.

Water conservation is the cornerstone of President Carter's National Water Policy, however, the national role in water conservation will be cooperation, not preemption of local and State authority The National Water Policy also calls for improved planning and management of Federal water resources programs and increased attention to environmental quality. To implement the objectives of the policy, 13 directives were issued to various responsible Federal agencies. Specific tasks were assigned and each agency is required to seek input from State, county, local, and non-governmental agencies in the development of implementation plans. Nineteen task forces are at work implementing the directives in areas such as floodplain management, Soil Conservation Service programs, Federal water pricing, technical assistance, loan and grant programs, agricultural assistance, nonstructural flood protection, and Federal and Indian reserved water rights. Up-to-date summaries of agency actions can be found in the 'Final Summary Report' of Water Conservation Task Force 6A. Funding to assist states with water conservation will be available when the Water Conservation Technical Assistance Grants Program is authorized. It will provide matching funds for education

and information dissemination, technical assistance, and water exchanges. It is the national viewpoint that there is no national water crisis -- and, with emphasis on conservation, there will not be a crisis. (See also W81-00160) (Seigler-IPA)
W81-00161

URBAN WATER BALANCES CONSIDERING CONSERVATION,
American Society of Civil Engineers, Marblehead, MA. Urban Water Resources Research Program.
M. B. McPherson.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979. Franklin Pierce College, Rindge, NH, p 28-36, 1979. 2 Fig, 22 Ref.

Descriptors: *Water conservation, *Urban hydrology, *Water sources, Urbanization, City planning, Potable water, Input-output analysis, Industrial water, Domestic water, Water supply, Water allocation(Policy), Water loss, Water users, Water utilization.

A graphical representation of water quantities in a hypothetical urban area of one-million inhabitants is used along with a composite public water/waste water input - output balance to illustrate the major factors in water conservation for urban areas. Although such water balance inventories describing the quantity and quality aspects of water are advocated as a referencing tool for planning in metropolitan areas, very few have been developed. In accounting for water quantities two major factors are: (1) the bulk of supplied water originates outside of urban area; and (2) over half of all water is in private hands. Public water supply withdrawals are a relatively small fraction of total metropolitan withdrawals, and domestic use represents a modest fraction of these public water withdrawals. Due to these proportions and ambiguities in the amount of 'unaccounted-for' water in a system, any savings in domestic use through conservation would be difficult to prove. 'Dual' community water distribution systems represent an area of likely conservation since only a small fraction of public water supplies needs to be of 'drinking water' quality. Other major areas for conservation are the reduction of leakage and the reduction of peak rate usage. A long-term important national water development is the greater appreciation of the complex interconnections, interactions, and interrelations among the numerous facets of water in the urban environment. (See also W81-00160) (Seigler-IPA)
W81-00162

LOCAL DROUGHT-INDUCED CONSERVATION CALIFORNIA EXPERIENCES,
California State Dept. of Water Resources, Sacramento.
G. H. Meral.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 37-46, 1979. 1 Fig, 3 Tab.

Descriptors: *California, *Water conservation, *Drought tolerance, Water utilization, Agriculture, Irrigation water, Water reuse, Water policy, Brackish water, Droughts, Water shortage, Water users, Water demand, Water supply.

Following the positive public response to the need for water conservation in California during the drought of 1976-77 an extensive program of planning for future water conservation is being developed. As public awareness of the drought severity developed in 1977, customers in the Marin Municipal Water District decreased their consumption by 64%, 7% more than the mandated 57% reduction. Two major drought measures used were the increased use of reclaimed water, especially for irrigation, and the construction of a temporary pipeline from the East Bay across the Richmond-San Rafael Bridge. A comparison of 1977 and 1979 water usage shows that water conservation practices are persisting although not at the peak drought level. Permanent conservation measures include low-flush toilets and low flow showers and lavatory faucets. A benefit to cost ratio of about five to one was found for implementing conservation equipment. A 15% reduction in demand through conservation is the goal of the State Water Project in Southern California by the year 2000. With cooperation the amount of water used for urban landscape irrigation could be reduced by 1.4 cubic hectometers in the same period. Conservation in agriculture, the largest single water user in California, will involve the increased use of drip irrigation, the use of brackish water for irrigation, and the development of salt-tolerant crops. Water conservation must be a tool for day-to-day operations as well as long-term drought planning. (See also W81-00160) (Seigler-IPA)
W81-00163

WATER CONSERVATION IN NORTHEASTERN ILLINOIS,
Illinois State Dept. of Transportation, Chicago. Div. of Water Resources.
F. L. Kudrna, and D. Injerd.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979. Franklin Pierce College, Rindge, NH. p 47-57, 1979. 7 Ref.

Descriptors: *Illinois, *Water conservation, *Lake Michigan, Water policy, Plannin, Water supply, Water utilization, City planning, Water reuse, Water shortage, Water rates, Humid areas, Wet climates, Water demand.

Water conservation is becoming accepted practice in Northeastern Illinois despite the apparently ample supply of water from Lake Michigan and an annual precipitation average of 33 inches. Litigation limits the amount of water that Illinois can divert from Lake Michigan to 3,200 cfs and other water supply sources in the area are hydrologically limited, thus conservation is a necessity. Three major points in the area's conservation program are: (1) to reduce the amount of lake water required for operation of the Sanitary and Ship Canal; (2) to reduce the water lost through leakage at lakefront controlling works; and (3) to require all entities receiving lake water to implement water conservation techniques. Various water conservation techniques appropriate for Northeastern Illinois include water conservation ordinances, outside water use controls, retrofitting, adjusting water rate structures, water conservation education, industrial water reuse, and low consumption appliances. Steps are also being taken to ensure efficient water systems management. It is difficult to quantify the effects of water conservation techniques and reductions in Illinois will seem minor compared with drought stricken areas like California, but the steps taken here are important in the establishment of a water resource balance for the area. (See also W81-00160) (Seigler-IPA)
W81-00164

THE ECONOMICS OF WATER CONSERVATION,
California Univ., Santa Barbara.
W. D. Morgan.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 93-13, 1979, Franklin Pierce College, Rindge, NH, p 59-68, 1979, 2 Fig, 27 Ref.

Descriptors: *Water conservation, *Economics, *Evaluation, *Cost-benefit analysis, Alternative costs, Water demand, Prices, Water supply, Mathematical models, Input-Output analysis, Forecasting, Water costs, Planning, Water allocation, Water rates.

It is the view of economists that financial incentives are an integral part of determining water use and therefore are an integral factor in water conservation. Economists consider water to be a 'good' and, if provided full information, consumers will choose the correct amount for them given their income or output. Water is scarce, which makes it an economic good, it has declining marginal value, and it is divisible and can be allocated over time and space. A demand curve can be used to show internal information about water supply and demand for a given unit such as a household or industrial firm. A demand curve shows the quantity of water needed at all alternative prices while holding all other influencing factors constant. A framework for the allocation of water is developed using the constraints of supply and demand while considering factors such as specific user group pricing, prices different from marginal costs, seasonal or peak load pricing, and price flexibility. It is important that water purveyors get rid of all subsidies and begin to calculate the real resource cost of the water they supply. Demand management is needed to develop rate structure related to marginal cost pricing. Information must be provided so users can conserve by making wise economic short-run and long-run decisions. (See also W81-00160) (Seigler-IPA)
W81-00165

WATER CONSERVATION IN HOUSING,
Department of Housing and Urban Development, Washington, DC.
J. C. Hancock.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 69-73, 1979.

Descriptors: *Water conservation, *Water policy, *Federal government, *Domestic water, Water costs, Water supply, Water loss, Leakage, Water users, Water shortage, Regulation, Building codes, Legislation.

The draft report of Task Force No 9 of the President's Water Policy Initiatives on 'Water Conservation in Housing Assistance Programs' is summarized. Residential water conservation is to be accomplished at minimal cost and without reducing the quality of life of affected users. The Task Force found that it may be possible to reduce the current 70 gallons per person daily water consumption by as much as 15% within 10 years. Although residential consumption is only a small part of total consumption a visible water conservation effort in housing is essential if a water conservation ethic is to become part of the American way of life. Eight actions are recommended for early implementation including limited flow showerheads, flow aerators on faucets, water leakage surveys, metering of all water distribution pipes, and the modification of government standards. Twenty-two items needing short term research are listed along with fourteen that need long term research for proper evaluation. General factors affecting residential water use conservation that are interrelated with other water conservation considerations include the establishment of a general conservation ethic, land subsidence, domestic water use costs, leakage, and sewage plant operations. (See also W81-00160) (Seigler-IPA)
W81-00166

WATER CONSERVATION IN FEDERAL PROGRAMS,
Office of Water Research and Technology, Washington, DC.
G. D. Cobb.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 74-79, 1979.

Descriptors: *Water conservation, *Water policy, *Federal government, *Programs, Planning, Legislation, Water resources development, Water shortage, Water supply, Federal-State water rights conflicts, Government finance, Federal project policy, Administrative agencies, Water law, Water utilization.

President Carter's water policy statement and first 13 initiatives are designed to make certain that there is enough water of the right quality to meet all of the needs of the American people by placing emphasis on water conservation. Water conservation is defined in many ways such as wise water management or saving water at one place and time to make it available for more beneficial uses. In the past, Federal programs have often been too late, scattered, and uncoordinated. To change this the President has required that all Federal water programs be reassessed, reviewed, and examined for water conservation opportunities. Nineteen Task

Forces are conducting this coordinated analysis of Federal programs and water policy. A Water Policy Coordination Group keeps the Task Forces on schedule and on track. Task Force 6A has compiled a preliminary report of information and recommendations from 87 Federal prograns. A matrix was developed to rank the recommendations for the 87 programs. Reclamation rehabilitation was ranked number 1, waste treatment management was ranked number 3, and water resources research was ranked number 14. This effort begun by Task Force 6A must be continued and expanded if water management is to make full use of Federal programs. (See also W81-00160) (Seigler-IPA)
W81-00167

WATER CONSERVATION IN U. S. ARMY CORPS OF ENGINEERS PROGRAMS,
Corps of Engineers, Washington, DC. Office of Policy.
D. B. Duncan.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 80-82, 1979.

Descriptors: *Water conservation, *Water policy, *Federal government, *Corps of Engineers, Water resources development, Reservoirs, Water loss, Environmental effects, Water supply, Planning, Water utilization, Project planning, Project benefits, Alternate planning, Programs.

The Corps of Engineers defines water conservation as any beneficial reduction in water use or in water losses. From this, water management practices constitute conservation only when their purpose is to conserve a given supply of water through reduction in water use (or loss) and when their total national economic and environmental benefits outweigh their costs in these areas. The Corps of Engineers must apply sound conservation principles in the use of water by the agency, and water conservation must become a basic factor in planning to satisfy future water supply needs. To implement water conservation the Civil Works program has five functional areas: planning, design and construction, reservoir regulation, operation and maintenance, and regulatory activities. Planning represents the area with the greatest potential for conservation. Policy studies are currently underway to meet planning needs. Design and construction activities for conservation will be site specific and careful conservation reviews will be conducted during the stages of preauthorization, postauthorization planning, and design. Guidelines have been issued by the Chief of Engineers to improve water management at existing reservoir projects. In the future an evaluation process will be developed to permit a consistent trade-off between water conservation practices and increments of additional water supply. (See also W81-00160) (Seigler-IPA)
W81-00168

WATER SUPPLY SYSTEM FAILURES WITH CONSERVATION,
Camp, Dresser and McKee, Inc., Atlanta, GA. Water Resources Div.
G. S. Nicolson.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 94-102, 1979. 8 Fig, 2 Tab, 2 Ref.

Descriptors: *Water conservation, *Computer models, *Mathematical models, *Droughts, *Forecasting, Reservoirs, Streamflow forecasting, River forecasting, Statistical methods, Water demand, Water shortage, Probability, Synthetic hydrology, Statistical models.

A computer model that smulates streamflow and reservoir operation of an existing water supply reservoir system was used to forecast annual reservoir failures with two sets of demands and situations. The model uses both the historic record and a synthetic record. Water demand from the reservoir is increasing 1 to 2% annually with current withdrawals already exceeding the long-term safe yield. Should the above average rainfall trend of recent years end, or should a drought occur, water conservation measures will have to be taken to reduce demand. The computer model was used to analyze the results of such conservation measures during forecasted droughts. A streamflow model that preserves monthly means, standard deviations, serial correlation coefficient, and skew coefficient was used to generate the one hundred years synthetic record. Demand estimated from the historic record is less than that from the synthetic record for curves of equal probability of failure. A forecasting procedure was used to determine when the water demand should be reduced by conservation. The two simulations run had average demands of 0.85MAF and 0.79MAF. Failure probabilities of more than 20% and 10%, respectively, were found. Results show that for this reservoir system, forecasting and conservation have more impact on reducing failures when the probability of failure is high than when it is low. (See also W81-00160) (Seigler-IPA)
W81-00171

WATER CONSERVATION NEEDS AND APPROACHES IN HUMID AREAS,
North Carolina Water Resources Research Inst., Raleigh.
J. M. Stewart.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 130-136, 1979. 3 Fig, 1 Tab, 3 Ref

Descriptors: *North Carolina, *Water conservation, *Water policy, *Virginia, Water users, Water demand, Water costs, Industrial water, Humid areas, Wet climates, Water rates, Forecasting, Urbanization.

Despite being a humid water-rich State, North Carolina does have water use problems and conservation steps are being taken. Conservation measures can: (1) reduce treatment and construction costs; (2) reduce energy costs; (3) extend the use of high quality water sources; (4) extend the life of existing facilities; (5) reduce environmental impacts; and (6) improve on-site facility performance with decreased flows. North Carolina has disparities in geographic patterns of water availability and population distribution. Large urban areas are located on divides or on river headwaters. Also, the State has many high water consumption industries. Water use continues to increase annually with 1975 figures showing per capita water use at over 1,200 gallons per day. Water uses are expected to double in the next 40 years. Water conservation is being encouraged by the Environmental Management Commission. A bonus priority system for State grants was established to give priority to applicants who practice water conservation methods. The Atlanta Regional Commission has also adopted specific policies to promote water conservation. In Virginia, the Fairfax County Water Authority has developed a rating schedule to promote conservation and equality by assessing an excess usage charge to customers who use 1.3 times their winter consumption in the summer. (See also W81-00160) (Seigler-IPA)
W81-00175

HUD/NBS RESIDENTIAL WATER CONSERVATION PROGRAM,
National Bureau of Standards, Washington, DC.
L. S. Galowin.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 137-138, 1979.

Descriptors: *Water conservation, *Potable water, *Laboratory tests, Water policy, Cost-benefit analysis, Design criteria, Building codes, Design standards, Specifications, Drainage systems, Plumbing, Pipes, Water demand.

Multi-year laboratory research investigations are being conducted by the National Bureau of Standards to develop standards for water conserving potable water systems in buildings. Included in the research are the total building plumbing system, water supply distribution, fixtures, waste drainage branches, and other treatment facilities. The research is designed to establish: (1) test methods for buildings; (2) guidelines of performance for plumbing codes; (3) Minimum Property Specification water reduction provisions; (4) acceptance factors throgh human factors research; and (5) economic evaluation procedures. The research is categorized into the following areas: water efficient fixtures technology; demand for water; efficiency of drainage systems; drainage, waste, vent systems; and usage and acceptability factors. These categories are briefly described. (See also W81-00160) (Seigler-IPA)
W81-00176

NORTHERN CALIFORNIA RATIONING LESSONS,
North Marin County Water District, Novato, CA.
J. O. Nelson.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 139-146, 1979. 2 Fig, 2 Ref.

Descriptors: *California, *Water conservation, *Rationing(Water), *Water shortage, Droughts, Water supply, Irrigation water, Industrial water, Plumbing, Water management(Applied), Regulation, Water rates, Arid lands.

Evidence collected in connection with the California drought indicates that in a similar area, given a serious water shortage and adequate communication with the consumers, a reduction in water use of between 25 and 40% can be achieved when an emergency rationing plan for residential water consumption is implemented. Under these conditions reductions in commercial consumption of up to 25% are also possible. Rationing involves critical allocation decisions so that the least harm possible will result. In nearly every instance where mandatory rationing was implemented in California, Consumers cut water usage even more than requested. Communication is the key to rationing so that the consumer makes a voluntary commitment. Four distinct rationing forms were used: (1) percentage reduction (compared to normal use in a similar billing period); (2) seasonal allotment (a per capita or per home allotment -- increased in summer and decreased in winter); (3) fixed allotment (per capita or home allotment based on calculated need); and (4) sprinkler ban. Overall it was concluded that under drought conditions rate penalties for exceeding allotments were not needed Most programs provide for service shut off in the event of repeated violations. The total sprinkler ban was found to be the least successful method. (See also W81-00160) (Seigler-IPA)
W81-00177

DENVER -- IMPORT AND REUSE CONSERVATION LESSONS,
Denver Water Dept., CO.
R. D. Wiley
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 165-173, 1979. 5 Fig, 4 Ref.

Descriptors: *Water conservation, *Colorado, *Denver, *Colorado River, Water supply, Water utilization, Water demand, Successive use, Environmental effects, Planning, Water resources development, City planning, Urbanization, Semiarid climates.

The Denver Water Department which provides treated water service to over 900,000 people is having to make hard decisions concerning the realities of conservation versus the expense and environmental unpopularity of further development of Colorado River waters. Denver, located on a semiarid plain, has an average rainfall of only 15 inches. Approximately 70% of Colorado's surface water flows away from Denver down the sparcely populated Western Slope of the Continental Divide The South Platte River, which flows past Denver, collects only 10% of the State's water. At present Denver gets 60% of its water supply by diverting water flow from the Western Slope. There is much

negative sentiment concerning future increases in diversion from the Western Slope and the Colorado River. One conservation measure being conducted is successive use or reuse. A one million gallon-per-day reuse demonstration plant is being designed for future construction. A full-scale reuse program could be implemented by about the year 2000 if the demonstration plant is successful. Even with conservation and successive use the demand for water will exceed supply sometime around the turn of the century. Also, if water rights to Western Slope water are not utilized they will be lost to downstream urban areas. (See also W81-00160) (Seigler-IPA)
W81-00180

CONSERVATION BETWEEN AND BEYOND DROUGHTS,
Bureau of Land Management, Washington, DC.
J. E. Sabadell.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 196-201, 1979. 3 Fig, 1 Tab.

Descriptors: *Droughts, *Water conservation, *California, Planning, Industrial water, Agriculture, Water resources deve lopment, Social aspects, Water utilization, Urbanization, Domestic water, Political aspects, Environmental effects.

The California drought of 1976-1977 demonstrated that water conservation can be quite successful in urban areas. The highest reductions were achieved in the residential sector, however, consumers are slowly returning to pre-drought consumption behavior. Residential water consumption is returning to normal more slowly than consumption in commercial, industrial, and agricultural activities. Even at the height of the drought, the agricultural sector reacted mainly to economic pressures for water conservation. Four conclusions drawn from these facts are: (1) the inevitability of droughts should be recognized and should be an integral part of planning; (2) the manipulation of nature conditions is limited by ecological impacts, and by economic, social, and political factors; (3) many systems are operating at their carrying capacity and have no resilience; and (4) there is too little concern about future droughts once a crisis period has passed. The Bureau of Reclamation has identified a priority list of actual and future water problems for the 11 Western States. Problems on the list include water for energy resources development, water for Indians, Colorado River water supply and salinity, water conservation and reuse, protection of estuaries, and preservation versus development. (See also W81-00160) (Seigler-IPA)
W81-00183

EFFECTS OF CONSERVATION MEASURES ON WATER DEMANDS,
Camp, Dresser and McKee Inc., Springfield, VA.
R. S. Taylor.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 202-203, 1979.

Descriptors: *Washington(DC), *Water conservation, *Urbanization, Water shortage, Droughts, Domestic water, Social aspects, Economic analysis, Water utilization, Forecasting, Mathematical models, Regression analysis, Planning.

An evaluation of the impacts of different levels of water shortages on different classes of users and the ability of conservation to minimize these shortages was conducted for the Metropolitan Washington Area (MWA) by the Baltimore District, Corps of Engineers. This evaluation is briefly summarized. Eight subregional areas were identified to simplify the evaluation. Water use in the MWA is 66% residential, 11% commercial/industrial, and 14% governmental. Due to the high percentage of residential use, any program of water conservation must involve residential users at a high level of participation. Several alternative conservation 'scenarios' were developed with future water demands to demonstrate the relative effectiveness of conservation techniques. The methodology used for these projections involved current water use levels, projected population, employment, and housing. Water demand is estimated in each of the five major user categories from 1980 to 2030 in 10-year increments. Short-term responses to an expected water shortage in the MWA were also developed and economic losses and social impacts are analyzed. (See also W81-00160) (Seigler-IPA)
W81-00184

THE FEDERAL OVERVIEWER -- BUREAU OF WATER CONSERVATION,
Texas Tech Univ., Lubbock. Water Resources Center.
R. M. Sweazy.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 245-250, 1979.

Descriptors: *Federal Government, *Water conservation, *Water policy, Planning, Legislation, Water resources development, Federal-State water rights conflicts, Government finance, Water rights, Water demand, Water supply, Cost-benefit analysis, Environmental effects, Decision making.

Water conservation when properly implemented is highly desirable, however, a new or modified Federal Government bureau to prepare and enforce detailed universally-applicable regulations is not desirable. If there is to be a defined Federal policy it should include consideration of the supply and demand and both should be subjected to cost-benefit analyses. In general the existing Federal agencies such as the Corps of Engineers, the Bureau of Reclamation, and the Soil Conservation Service have done a good job and are adequate to handle future water policy objectives. States should set their own water policy with as little Federal encroachment as possible. Any Federal Government water conservation policy should have as its cornerstone a sound recognition of State priority in water management. The Federal Government can aid states by providing incentives to sound conservation and eliminating disincentives. Federally financed projects should set prices to discourage the excessive use of water. It is also possible that through the Water Resources Council the Federal Government could provide an information and assistance clearinghouse to promote water conservation. (See also W81-00160) (Seigler-IPA)
W81-00189

3E. Conservation In Industry

LOW-COST EVAPORATION CONTROL USING WAX IMPREGNATED FOAM,
Arizona Univ., Tucson. Water Resources Research Inst.
C. B. Cluff, L. Onyskow, F. Putman, S. Chesser, and D. Powelson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-116832, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, September, 1980. 28 p, 11 Fig, 7 Tab, 11 Ref. OWRT-A-091-ARIZ(1), 14-34-0001-8003.

Descriptors: *Evaporation control, *Reservoir evaporation, *Water conservation, *Floats, *Plastics, Water proofing, Concretes, Joints(Connections), Design, Engineering structures, Engineering, Equipment, Evaporation, Alcohols, Thin films, Floating, Polymers, Research and development, Reservoirs, Water management(Applied), Water loss, Water quality, Moisture proofing, Coatings.

A one-year study was conducted on the development of improved methods of water evaporation control using wax impregnated foam. Expanded polystyrene (EP) foam and 140 degrees F melting paraffin were used. A pressure chamber was used to wax impregnate EP sheets. Laboratory tests led to modification of the pressure chamber into a vacuum chamber, but problems arose in impregnating the interior of the sheets using a vacuum. The pressure model, however, was successfully used to impregnate up to 3-inch thick sheets of EP. It was also observed that the paraffin-impregnated rafts worked very well until temperatures above 100 degrees F were encountered under dusty conditions. Such high temperatures caused the waxed surface to become tacky, and the dust darkened the otherwise white surface, which in turn captured more heat and then more dust. Higher melting point waxes were studied to reduce the accelerated weathering noted at high temperatures, but no satisfactory combinations were found. Use of a high melting (near 190 degrees) polyethylene copolymer wax was too viscous for impregnation, but provided a hard surface coating when previously wax impregnated EP sheets were dipped into the molten polyethylene wax. Development study on wax impregnated lightweight concrete rafts, and connecting rafts with sheet metal strips bonded to EP, was also reported. (Zielinski-IPA)
W81-00112

PROCEEDINGS OF THE CONFERENCE ON WATER CONSERVATION NEEDS AND IMPLEMENTING STRATEGIES,
For primary bibliographic entry see Field 3D.
W81-00160

ULTRAFILTRATION SYSTEM PAYS FOR ITSELF,
Abcor, Inc., Wilmington, MA.
S. Pinto, and L. Gould.
Industrial Wastes, Vol 26, No 5, p 16-18, September/October, 1980. 3 Fig, 1 Tab.

Descriptors: *Filtration, *Semipermeable membranes, *Cleaning, *Metals, *Alkaline cleaner baths, Industrial plants, Costs, Water pollution, Industrial wastes, Waste treatment, Conservation.

An ultrafiltration system in an alkaline cleaner bath used for metal pretreatment is described. Ultrafiltration is a pressure-driven process for separating high-molecular-weight solutes or colloids from water solutions using a semipermeable membrane. The use of such a system reduces chemical costs by increasing bath life and reducing dumping frequency, improves parts cleaning by removing soil from the bath, reduces cleaner bath maintenance, and reduces pollution caused by cleaner bath disposal. The purpose of the system is to remove oil and solids from the bath. The ultrafilter serves as a 'kidney' on the alkaline cleaner bath. The system consists of a processing tank, ultrafiltration membranes, heat exchanger, and washing tank. Solid cleaner feed feeds through the system, continuously recycling through the membrane tubes and returning to the process tank. The maximum length of the ultrafiltration process cycle is related to tank size, permeation rates, and cleaner soil content, which will differ for each system. (Baker-FRC)
W81-00230

3F. Conservation In Agriculture

INCENTIVES FOR AGRICULTURAL WATER CONSERVATION,
Sonnen (M. B.) Co., Inc., Walnut Creek, CA.
M. B. Sonnen, B. B. Dendy, and K. P. Lindstrom.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-109787, Price codes: A06 in paper copy, A01 in microfiche. Report prepared for Office of Water Research and Technology, July 1980, 108 p, 3 Fig, 13 Tab, 44 Ref, Append. OWRT-C-90134-C(No 9428)(1), 14-34-0001-9428.

Descriptors: *Water conservation, *Irrigation, *Water resources development, *Water management, Agriculture, Ground water, Droughts, Planning, Competing uses, * Legal aspects, Economics, Surface waters, California, Texas, Water policy, *El Paso, *San Joaquin Valley, *Sacramento River Valley, Western U.S. water supplies, Water conservation methods, Economic incentives.

Four water districts and thirteen individual farmers were interviewed about their current water conservation methods and possible incentives that might be instituted to encourage still further water sav-

ings. Interviewees farmed in central California and west Texas, and all were using both Federally supplied surface water and local ground water. These farmers were all using several methods of conservation. Tail-water return systems and laser-controlled land leveling were the most prevalent. Farmers agreed that conservation is feasible to a point; it is done in reaction to economic forces; and it will eventually have to be supplemented with additional water supply developments. One of many conclusions drawn was that water conservation as one element in overall water management planning policy could be defended and was worthwhile, whereas a policy of having water conservation take the place of needed additional water development projects could not be sustained. Additionally, water savings among western U.S. irrigators through conservation could not be relied upon to reduce total water withdrawals over current amounts by more than roughly 15%, because western farmers have been using water sparingly for many years.
W81-00003

ECONOMIC POTENTIALS FOR AGRICULTURAL WATER-SAVING USING ALTERNATIVE IRRIGATION TECHNIQUES,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
H. J. Vaux, Jr., and A. W. Marsh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112732, Price codes: A03 in paper copy. California Water Resources Center, University of California, Davis Technical Completion Report, September 1980, 43 p, 2 Tab, 1 Appen. (California Water Resources Center Project UCAL-WRC-W-553). OWRT-A-072-CAL (1).

Descriptors: *Irrigation efficiency, *Irrigation practices, *Irrigation systems, *Economic efficiency, Energy, Linear programming, Pumping, Stress, Agriculture, Adoption of practices, Model studies, *California.

More efficient use of water used by irrigated agriculture in California will likely be necessary if the significant economic role played by this industry is to be maintained in the future. Necessary economic data and methodologies are developed to assess the extent to which water savings can be realized through widespread adoption of water-saving irrigation technologies. Special emphasis is placed on identifying the extent to which water saving irrigation technologies substitute energy for water. An assessment of the methods developed was performed on the agricultural sector of western Riverside county of southern California. A linear program model develops the responses of agricultrual production to changes in the cost and availability of irrigation water and pumping energy. A new method for limiting cropping pattern shifts is analyzed. The results of the model and the possible impact of the model's assumptions on these results are discussed. Some conclusions drawn from the analysis include: an increasing rate of decline in irrigated acreage, particularly of field crops, due to increasing resource prices; a much higher eleasticity of demand for imported water than for ground water; increasing use of sprinkler and particularly drip irrigation as water price rises; and a large potential for water stressing of crops if better information becomes available on water production functions. Implications of the results are discussed and ways of improving the accuracy of the model are suggested. (Snyder - Calif)
W81-00024

IMPACT OF ALTERNATIVE ENERGY PRICES, TENURE ARRANGEMENTS & IRRIGATION TECHNOLOGIES ON A TYPICAL TEXAS HIGH PLAINS FARM,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
J. A. Petty, R. D. Lacewell, D. C. Hardin, and R. E. Whitson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112674, Price codes: A13 in paper copy. Texas Water Resources Institute, Texas A & M University Technical Report No 106, May 1980. 269 p, 32 Tab, 20 Fig, 79 Ref, 4 Append. OWRT-A-045-TEX (1), 14-34-0001-9046 & 0146.

Descriptors: *Irrigation, *Crop production, *Irrigation wells, *Costs, *Irrigation operation and maintenance, Pumping, Irrigation efficiency, Technology, Irrigation fuel, *Texas High Plains.

Irrigation is a major contributing factor in crop production on the Texas High Plains. A recursive linear programming model for a typical Texas High Plains irrigated farm was developed to evaluate expected impact of price changes, tenure and new technology. Model results indicate that irrigation would be terminated when the price of natural gas reached about $7.00 per mcf. Annual returns (above variable and fixed costs) were reduced by about as much as 30%, and the present value of returns to water was reduced by as much as 80% as the natural gas price was increased annually by $0.25 per mcf (from $1.50 per mcf). The economic life of deep groundwater was shortened by as much as 18 years. Renter-operators are even more vulnerable to rising natural gas prices than are owner-operators. Substantial economic gains appear feasible through improved pump efficiency. Results indicate that irrigation can be extended by 11 or more years with 50% improved distribution efficiency. In addition, the increase in present value of groundwater on the 1.69 million irrigated acres of the Texas High Plains was estimated to be $995 million with 50% improved efficiency.
W81-00032

A LINEAR PROGRAMMING MODEL OF AGRICULTURAL ACTIVITY AND RESOURCE USE UNDER CHANGING RESOURCE CONDITIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
S. A. Hatchett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115693, Price codes: A06 in paper copy, A01 in microfiche. Master of Administration, Thesis, August 1980. 114 p, 14 Fig, 12 Tab, 2 Append. (California Water Resources Center Project UCAL-WRC-W-553).

Descriptors: *Irrigation water, *Agriculture, *Pumping, *Energy, *Costs, Linear programming, Mathematical models, Crop production, California, Sprinkler irrigation, Drip irrigation, Elasticity of demand, Irrigation efficiency.

The response of agricultural production to changes in the cost and availability of irrigation water and pumping energy is analyzed. A linear program is developed to model these responses for the Western Riverside County area of Southern California. A new method for limiting cropping pattern shifts is postulated and analyzed. The results of the model and the possible impact of the model's assumptions on these results are discussed. Some conclusions drawn from the analysis include: an increasing rate of decline in irrigated acreage, particularly of field crops, due to increasing resource prices; a much higher elasticity of demand for imported water than for ground water; increasing use of sprinkler and particularly drip irrigation as water price rises; a large potential for water stressing of crops if better information becomes available on water production functions. Implications of the results for resource planners are discussed, and ways of improving the accuracy of the model are suggested. (Snyder-Calif)
W81-00083

AN ANALYSIS OF THE PLANT SOIL CONTINUUM USING ELECTROPHYTOGRAMS,
Arizona Univ., Tucson. Dept. of Electrical Engineering.
W. Gensler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-116824, Price codes: A05 in paper copy, A01 in microfiche. Project Completion Report, September 1980. 76 p, 27 Fig, 7 Tab, 7 Ref, 1 Append. OWRT-B-061-ARIZ(1), 14-34-001-858.

Descriptors: *Electrodes, *Electrical conductance, *Soil moisture, Irrigation practices, *Irrigation efficiency, *Cotton, *Pecans, Electrical properties, Conductivity, Soil physical properties, Soil water, Moisture content, Moisture availability, Soil moisture meters, Irrigation water, Irrigation programs, Water utilization, Water supply, Water conservation, Water control, Irrigation systems, Crops, Analysis, Analytical techniques.

While visual observation is the most widely employed method of deciding when to irrigate, there is a definite need for development of a meaningful and reliable instrumentation system to obtain background data for water application decisions. Direct electrical measurement by the electrophytogram technique was early reported to provide a relation between plant water status and electropotential activity. The basic objective of this study was to quantify this relation such that irrigation schedules could be predicted. A remote sensing capability was established to determine the relation between agricultural water usage and plant electropotentials at two commercial farming sites and an experimental university site in southern Arizona, with plant electropotential activity monitored during successive irrigation cycles in cotton and pecans. These plants were found to have a definite electrical response to changes in water status. A quantitative relation to predict irrigation schedules is presently being developed with these data. Systemic plant electropotential responses were also observed, indicating the existence of a regulatory physiological mechanism over widely separated parts of the plant. Further, fruition of the cotton boll was related to the electropotential response over the long term, suggesting use of electropotential data to predict harvest timing. (Zielinski-IPA)
W81-00111

IRRIGATION PIPE GATE VALVE,
L. W. Clements.
U.S. Patent No 4,190,232, 5 p, 9 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 991, No 4, p 1276, February 26, 1980.

Descriptors: *Patents, *Irrigation, *Application equipment, Valves, Control, Irrigation efficiency, Irrigation operation and maintenance.

An irrigation pipe laying crosswise of a series of furrows has gate valves mounted in its side spaced to match each furrow. Each gate valve includes a generally elliptical, elastomeric, grommet-like frame fitting on the periphery of a recessed lip portion of the pipe defining an opening, and also includes a tubular slide slidable in the frame between a closed position and three open positions, one perpendicular to the pipe and two others cocked to either side to direct water to the outer of the three furrows. (Sinha-OEIS)
W81-00125

PROCEEDINGS OF THE CONFERENCE ON WATER CONSERVATION NEEDS AND IMPLEMENTING STRATEGIES,
For primary bibliographic entry see Field 3D.
W81-00160

HYDROLOGY AND POLITICAL INFLUENCES ON WATER SUPPLY,
Harza Engineering Co., Chicago, IL.
J. E. Priest.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 83-87, 1979.

Descriptors: *Political aspects, *Water conservation, *Hydrologic aspects, *Urban hydrology, Watersheds(Basins), Lake Michigan, Illinois, Runoff, Recharge, Groundwater, Water measurement, Water allocation policy, Decision making, Indus Basin System.

Three representative programs are discussed to show that while hydrologic analyses are imprecise and generate controversy and conflict, they do aid in the implementation of needed water supply and conservation measures. Factors to be considered in dealing with the hydrology of an allocation system include measuring the supply, identifying a base

period for supply estimates, forecasting supply and conservation changes, and selecting an equitable allocating base. The Indus Basin System, with agricultural related conservation needs measured in tens of millions of acre feet is used to illustrate how hydrology issues enter into the allocation and conservation process. Other examples used are the urban northern Illinois area with a Great Lakes diversion totalling over 2 million acre feet annually, and the Lake Minnetonka watershed near Minneapolis with a delicate hydrologic balance having only a few thousand acre feet of runoff. Hydrologists work will continue to be controversial due to the importance of opinion and judgement. Hydrologists will continue to make the best estimates possible to implement beneficial programs while providing as much flexibility for the future as possible. (See also W81-00160) (Seigler-IPA)
W81-00169

PERSPECTIVES ON AGRICULTURAL WATER USE AND CONSERVATION,
Nebraska Univ.-Lincoln. Dept. of Agricultural Engineering.
P. E. Fischbach.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 122-129, 1979. 6 Tab.

Descriptors: *Irrigation efficiency, *Water conservation, *Irrigation water, *Nebraska, *Irrigation systems, Energy, Cost analysis, Irrigation practices, Crop production, Scheduling, Leaching, Soil water, Root zone, Deep percolation.

Irrigation statistics for 1973 indicate that Nebraska irrigators used 617.8 million kilowatts of electricity, 101 million gallons of diesel fuel, 53.5 million gallons of LP gas, and 5,738 million cubic feet of natural gas to power irrigation pumping plants. Also, most irrigation systems have excess capacity that farmers use to apply unneeded water. Many systems are run nearly continuously during the growing season regardless of rainfall or soil conditions. Irrigation water losses due to runoff or deep percolation represent excess energy requirements. Irrigation systems have different energy requirements with the gated pipe system being the most efficient for Nebraska. New automatic irrigation systems along with improved irrigation management procedures could result in a 37% energy savings over present usage. Nitrate leaching, loss of nitrogen from the root zone, can also occur when excessive irrigation water is used. Increment feeding through the irrigation system could help to reduce this loss. Correct irrigation scheduling could save 35% of the water now used. At present energy prices, a gated pipe system could save $16.50 per acre with good scheduling and a center pivot system could save $28.30 per acre. At $2.00 an acre inch for water the savings here would add another $14.60 per acre. A technology transfer program is needed to train irrigators and consultants in these conservation measures. (See also W81-00160) (Seigler-IPA)
W81-00174

DROUGHT LESSONS FROM AGRICULTURE,
Utah State Univ., Logan. Dept. of Economics.
H. H. Fullerton.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979. Franklin Pierce College, Rindge, NH, p 174-181, 1979.

Descriptors: *Agriculture, *Droughts, *Water conservation, *Water policy, Forecasting, Government supports, Drought tolerance, Water supply, Management, Planning, Economics, Water allocation, Water shortage, Water resources development.

The impact that modifications in institutions, management, and policy will have on water conservation will depend greatly on their long-run economic feasibility. Severe droughts in the 1930's and 1970's have produced the following observations: (1) drought prediction within a timeframe useful for planning is virtually nonexistent; (2) estimated drought damages are in general grossly overstated; (3) in almost all cases alternative water sources are less energy efficient than traditional supplies; (4) agricultural prospectives differ greatly from individual producer and consumer perspectives; (5) water resource flexibility is directly related to property rights; (6) governmental expansions can be justified on egalitarian grounds; (7) drought mitigating practices may have serious long-run consequences; (8) drought conditions complicate use efficiency; and (9) drought research cannot be studied as an isolated problem. Little can be gained by continuing to isolate drought from other areas such as meteorology, water management, and land/water interrelationships. This is especially true when drought study financing is being sought. Drought provides lessons by causing us to reexamine our conventional wisdom and by forcing us to give research attention to the fuller utilization of data and research information for immediate management and policy decisions. (See also W81-00160) (Seigler-IPA)
W81-00181

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

EFFECTS OF STREAM CHANNELIZATION ON BOTTOMLAND AND SWAMP FOREST ECOSYSTEMS,
North Carolina State Univ. at Raleigh. School of Forest Resources.
T. E. Maki, A. J. Weber, D. W. Hazel, S. C. Hunter, and B. T. Hyberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-111429, Price codes: A09 in paper copy, A01 in microfiche. Research Institute of The University of North Carolina, Raleigh, Report No 147, 1980, 135 p, 26 Fig, 22 Tab, 4 Append. OWRT-B-094-NC (4), 14-34-0001-6107.

Descriptors: Silviculture, *Channeling, *Environmental effects, Channel improvement, *Swamps, *Ecosystems, Surface drainage, Vegetation regrowth, Drainage effects, Streamflow, Wetlands, *Forests, *North Carolina.

An investigation was undertaken to determine the effects of stream channelization on the bottomland-swamp forest ecosystems of Eastern North Carolina. The ground water regimes in the floodplains of cutover and non-cut areas of four channelized streams and seven non-channelized streams were monitored by means of lines of wells positioned perpendicular to each stream channel. The water levels in the wells were measured weekly between January 1975 and July 1977, providing the basis on which the plant communities of the cut and non-cut, channelized and non-channelized swamps could be compared. Growth studies indicated that channelization resulting in moderate average summer water levels was not necessarily detrimental to mature tree growth, including that of 'water loving' species such as water tupelo, swamp blackgum, and bald cypress. Evidence of severe dieback or loss of vigor was noted in trees along the channelized streams only in the few observed instances where water had been backed up by spoil material into stagnant pools or where several feet of soil had been piled against the bases of the trees. A midsummer count showed four times more small tree stems per hectare in the non-channelized areas than in the channelized areas. Survival and growth of planted water tupelo seedlings was notably greater along the non-channelized streams.
W81-00036

HYDROLOGY AND WATER QUALITY OF THE LOWER MISSISSIPPI RIVER,
Geological Survey, Baton Rouge, LA. Water Resources Div.
F. C. Wells.
Louisiana Department of Transportation and Development, Office of Public Works Water Resources Technical Report No 21, 1980. 82 p, 26 Fig, 5 Plates, 17 Tab, 50 Revf.

Descriptors: *Water quality, *Streamflow, *Discharge(Water), *Sediment transport, *Louisiana, Mississippi River, Flow rates, Chemical analysis, Water temperature, Bacteria, Heavy metals, Dissolved oxygen, Organic compounds, Pesticides, Path of pollutants, Benthos, Water utilization, Time of travel, *Lower Mississippi River(LA).

Average discharges for the Mississippi River at Vicksburg, Miss., and Red River-Tarbert Landing are 573,600 and 461,000 cubic feet per second, respectively. An average suspended-sediment load of 630,000 tons per day is transported past Red River-Tarbert Landing; approximately 77 percent as silf and clay. Concentrations of dissolved solids at St. Francisville and Luling, La., are less than 300 milligrams per liter 90 percnet of the time. Concentrations of trace metals are within the recommended limits for public-water-supply sources 99 percent of the time. Dissolved-oxygen concentrations exceed 75-percent saturation 90 percent of the time. DDT, dieldrin, endrin, diaxinon, 2,4-D are the most frequently detected pesticides. Concentrations of volatile organic compounds are generally less than 10 micrograms per liter, and concentrations of 14 semivolatile organic compounds have generally been less than 5 milligrams per liter. The most common and numerous benthic organisms collected are Corbidula and tubificid worms. An average of 6,300 million gallons per day of water was withdrawn from the river below St. Francisville in 1975 for industrial and municipal uses. Average decomposition rates for the Mississippi River ranged from 0.046 to 0.058 (per day, base e). (USGS)
W81-00064

THE EFFECTS OF USING GROUND WATER TO MAINTAIN WATER LEVELS OF CEDAR LAKE, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 2H.
W81-00066

EFFECT OF FLUCTUATING RESERVOIR RELEASE ON THE DOWNSTREAM ENVIRONMENT,
Michigan Technological Univ., Houghton. Dept. of Biological Sciences.
K. J. Kraft, and N. D. Mundahl.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115677, Price codes: A02 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, East Lansing, Project Completion Report, August, 1980, 17 p, 4 Fig, 8 Tab, 136 Ref. OWRT A-105-MICH(1), 14-34-001-9024, 0124.

Descriptors: *Sturgeon River(MI), *Reservoir releases, *Environmental effects, *Downstream, *Water quality, Benthic fauna, Benthos, Turbidity, Water temperature, Powerplants.

Temperature, depth, width, current velocity, turbidity, conductivity, and benthic macroinvertebrates were examined for one year above and below the Prickett Generating Station on the Sturgeon River. For most of the year this generating station operated during the day and shut down at night and on weekends. On days with on-off generator operation, downstream diurnal temperature ranges were similar to those upstream, but on days with continuous generation downstream temperatures for at least 10 km remained relatively constant. The maximum temperature upstream was 22C, 200 m downstream 24.5C, and 10 km downstream 23C. Current during generation more than doubled at 200 m downstream, but increased only slightly 10 km downstream. Depth during generation increased 75 cm at 200 m downstream and 40 cm 10 km downstream. Width during generation increased 7 to 10 m. Turbidity ranged from 7 to 12 ppm SiO2 and conductivity from 120 to 150 micro mhos/cm. Invertebrate density and biomass were lowest in May and highest in September and October. At 200 m downstream density averaged 5.6 x greater and biomass 6.9 x greater than upstream.

At 10 km downstream density averaged 2.4 x and biomass 1.7 x greater than upstream. The total number of taxa collected upstream was 56, at 200 m downstream 50, and 10 km downstream 61. A large, diverse benthic macroinvertebrate community occurred immediately downstream from the generating station suggesting that the on-off mode of generation may be less detrimental to downstream biota than continuous operation which dampens normal diurnal temperature fluctuations and delays seasonal temperature changes.
W81-00087

HYDROLOGY OF THE CHICOD CREEK BASIN, NORTH CAROLINA, PRIOR TO CHANNEL IMPROVEMENTS,
Geological Survey, Raleigh, NC. Water Resources Div.
C. E. Simmons, and M. C. Aldridge.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, paper copy $4.00, microfiche $3.50. Geological Survey Open-File Report 80-680, 1980. 27 p, 9 Fig, 8 Tab, 8 Ref.

Descriptors: *Effects, *Excavation, *Channel improvement, *Watersheds(Basins), *North Carolina, Data collections, Observation wells, Streamflow, Flood flow, Storm runoff, Surface groundwater relationships, Base flow, Water quality, Nutrients, Pesticides, Bacteria, Water pollution sources, *Chicod Creek basin(NC).

Extensive modification and excavation of stream channels in the 6--square mile Chicod Creek basin began in mid-1979 to reduce flooding and improve stream runoff conditions. The effects of channel improvements on this Coastal Pain basin's hydrology will be determined from data collected prior to, during, and for several years following channel alternations. This report summarizes the findings of data collected prior to these improvements. During the 3-year study period, flow data collected from four stream gaging stations in the basin show that streams are dry approximately 10 percent of the time. Chemical analyses of water samples from the streams and from eight shallow groundwater observation wells indicate that water discharge from the surficial aquifer is the primary source of streamflow during rainless periods. Concentrations of Kjeldahl nitrogen, total nitrogen, and total phosphorus were often 5 to 10 times greater at Chicod Creek sites than those at nearby baseline sites. It is probable that runoff from farming and livestock operations contributes significantly to these elevated concentrations in Chicod Creek. The only pesticides detected in stream water were low levels of DDT and dieldrin, which occurred during storm runoff. A much wider range of pesticides, however, are found associated with streambed materials. The ratio of fecal coliform counts to those of fecal streptococcus indicate that the streams receive fecal wastes from livestock and poultry operations. (USGS)
W81-00154

DRAINAGE FOR AN INDUSTRY/OFFICE COMPLEX,
Halff (Albert H.) Associates, Inc., Dallas, TX.
J. I. Novoa, and M. K. Koesling.
Public Works, Vol 111, No 10, p 64-65, October, 1980. 2 Fig.

Descriptors: *Flood plains, *Land reclamation, *Sumps, *Drainage engineering, *Sewers, Storm drains, Construction, Industrial plants, Excavation, Landscaping, Flood control, Land management, Texas.

A well planned office and industrial center was built in the reclaimed flood plain of the Elm Fork of the Trinity River in Texas. The district required construction of sumps within the subdivision to provide flood storage and installation of improved water mains, sanitary sewers, and storm sewers. The sump also was to provide an outlet for all other storm sewers. A reduced cost for storm sewers, an increased sump-storage capacity, the utilization of excess sump excavation to construct positive site drainage, and an attractive landscape were among the benefits derived from this design. (Baker-FRC)
W81-00211

4B. Groundwater Management

INCENTIVES FOR AGRICULTURAL WATER CONSERVATION,
Sonnen (M. B.) Co., Inc., Walnut Creek, CA.
For primary bibliographic entry see Field 3F.
W81-00003

RELATIONSHIPS OF DISSOLVED OXYGEN AND BIOCHEMICAL OXYGEN DEMAND IN SEWAGE EFFLUENT RELEASES,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
P. G. Sebenik.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115206, Price codes: A05 in paper copy, A01 in microfiche. M.S. Thesis, 1975. 71 p, 8 Fig, 11 Tab, 24 Ref, 2 Append. OWRT A-051-ARIZ(1), 14-31-0001-5003.

Descriptors: *Ephemeral streams, *Open channel flow, *Physicochemical properties, *Sewage effluents, Southwest U.S., Dissolved oxygen, Biochemical oxygen demand, Streamflow, Water quality, Path of pollutants, Groundwater, Seepage.C.

Bio-physicochemical measurements were made on treated sewage effluent releases at established locations within the channel of an ephemeral stream, the Santa Cruz River of Southern Arizona. Water quality samples were taken in chronological sequence, so that incremental flows at low and high hydrograph stages could be traced as the effluent moved downstream. Results indicate that DO concentrations at low effluent flows were higher than DO concentrations at high effluent flows; while, conversely, BOD concentrations at low effluent flows were generally lower than BOD concentrations at high effluent flows. Biochemical oxygen demand concentrations are affected by waste loadings, flow conditions, phytoplankton growth and nitrification. Mean river deoxygenation rates (kr) in sewage flows after six river miles from the Tucson Sewage Treatment Plant were always negative or increasing, which is probably due to nitrification, algal growth, and concentration of organic constituents through seepage losses.
W81-00088

A SUMMARY REPORT, SOUTHEAST CONFERENCE ON GROUND WATER MANAGEMENT, BIRMINGHAM, ALABAMA, JANUARY 30-31, 1980,
D. H. Howells.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119489, Price codes: A03 in paper copy, A01 in microfiche. Southeast Water Resources, Vol 2, No 2, Fall 1980. University of North Carolina Water Resources Research Institute, Chapel Hill, NC, 42 p. OWRT-B-123-NC(7), B-125-NC(6).

Descriptors: *Water management(Applied), *Groundwater resources, *Groundwater, *Conferences, *Water resources institute, Water utilization, Groundwater availability, Water pollution, Mathematical models, Water policy, Legislation, Waste water treatment, Runoff, Water resources, Water resources development, Planning, State governments, Southeast U.S., Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee, Virginia.

A summary report is given on a conference on Groundwater Management, the fourth in a series of invitational regional conferences on significant water resource problems of the Southeast. The objectives of this conference were to explore the strengths/weaknesses of State programs related to groundwater management and to identify/describe remedies in areas of legislation, administrative procedures, funding levels, research, technology transfer and education. Summaries contained in this report were taken from papers presented under categories on State groundwater programs/problems (covering Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee and Virginia), national policy, mathematical modeling for groundwater management, conjunctive management of ground and surface water, organic chemical pollution, well injection of wastes and runoff, waste water treatment for groundwater quality protection, and new programs in surface mining hydrology. General conclusions and recommendations on State programs and problems are summarized. (Zielinski-IPA)
W81-00122

GEOLOGIC AND HYDROLOGIC DATA FROM A TEST-MONITOR WELL AT FERNANDINA BEACH, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. P. Brown.
Available from OFSS,USGS Box 254 25, Fed. Ctr Denver CO 80225, paper copy $5.00, microfiche $3.50. Geological Survey Open-File Report 80-347, 1980. 36 p, 13 Fig, 7 Tab, 3 Ref.

Descriptors: *Hydrogeology, *Hydrologic data, *Test wells, *Groundwater, *Water quality, Water yield, Observation wells, Drilling, Sampling, Stratigraphy, Logging(Recording), Water analysis, Temperature, Aquifers, Florida, *Nassau County(FL), *Floridan aquifer(FL).

A 2,102-foot observation well was drilled at Fernandina Beach, Florida, to obtain geologic and hydrologic data. Drill cuttings, water samples, and water-level measurements were collected. Geologist's, driller's, and geophysical logs were completed. The well is constructed with 12-inch diameter casing to a depth of 515 feet and 6-inch diameter casing from 515 to 2,000 feet. The remainder is open hole. The uppermost 500 feet of material penetrated by the well consists of sand, clay, limestone, and dolomite. In the remainder of the hole, the material consists of fragmental and granular limestone and massive to finely crystalline dolomite, which comprise the Floridan aquifer in the area. After the well was completed, water levels in the monitored zone, 2,000 to 2,102 feet, were above land surface. During July and August 1979, water levels ranged from about 8 to 13 feet above land surface. Chloride concentrations of water sampled through the drill stem from a depth of 632 to 2,039 feet ranged from 25 to 710 milligrams per liter. Chloride increased markedly below 2,039 feet to a maximum of 7,800 milligrams per liter at 2,094 feet. After completion of the well, chloride was 8,100 milligrams per liter. (USGS)
W81-00151

HYDROLOGIC MONITORING PROGRAM IN ELDRIDGE-WILDE AND EAST LAKE ROAD WELL-FIELD AREAS, PINELLAS AND HILLSBOROUGH COUNTIES, FLORIDA, 1977 WATER YEAR,
Geological Survey, Tallahassee, FL. Water Resources Div.
B. F. Joyner, and J. M. Gerhart.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver CO 80225, paper copy, $5.00, microfiche $3.50. Geological Survey Open-File Report 80-345, 1980. 34 p, 20 Fig, 4 Tab, 13 Ref.

Descriptors: *Observation wells, *Monitoring, *Water levels, *Water quality, *Florida, Groundwater, Aquifers, Saline water-freshwater interface, Saline water intrusion, Rainfall, Pumping, Drawdown, Water table, Potentiometric level, Hydrologic data, *Floridan aquifer, Pinellas County(FL), Hillsborough County(FL), Well fields.

The observation-well network in the vicinity of the two well fields is described in detail. Data obtained from the network from October 1976 through September 1977, as well as rainfall and pumpage records, are presented and discussed. Below-normal rainfall caused the water table and potentiometric surface of the Floridan aquifer in Eldridge-Wilde well field to recover 2 feet less in September 1977 than in the previous September. Water levels in East Lake Road will field were approximately the same in Spetember of both years. The Southwest Florida Water Management District has established regulatory water-level and water-quality

limits in several observation wells. Water levels did not drop below regulatory limits during the year. Water from two deep wells west of Eldridge-Wilde well field exceeded the regulatory limits for chloride concentrations. The position of the 250 milligram per liter chloride line is shown in cross section in the vicinity of Eldridge-Wilde well field in September 1977. Network modifications are proposed that would result in a more comprehensive knowledge of the hydrologic system. (USGS)
W81-00153

GROUND-WATER DATA FOR BILLINGS, GOLDEN VALLEY AND SLOPE COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
L. O. Anna.
North Dakota County Ground-Water Studies 29--Part II, and North Dakota Geological Survey Bulletin 76--Part II, 1980. 241 p, 2 Fig, 1 Plate, 9 Tab, 25 Ref.

Descriptors: *Groundwater, *Basic data collections, *North Dakota, *Aquifer characteristics, *Water quality, Water supply, Groundwater availability, Hydrogeology, Water wells, Groundwater recharge, Well data, Water yield, Potential water supply, Observation wells, Water levels, Water users, Chemical analysis, Billings County(ND), Golden Valley County(ND), Slope County(ND).

The purpose of the investigation in Billings, Golden Valley, and Slope Counties, ND., was to determine the availability and quality of ground water for municipal, domestic, industrial, and irrigation uses. Specifically, the objectives were to: (1) determine the location, extent, and nature of the major aquifers and confining beds; (2) evaluate the occurrence and movement of ground water, including the sources of recharge and discharge; (3) estimate the quantities of water stored in the aquifers; (4) estimate the potential yields of wells tapping the major aquifers; (5) determine the chemical quality of the ground water; and (6) estimate the water use. The data in this report were collected between 1974 and 1977. The data consist of the following; (1) Geologic and hydrologic records for 723 wells, test holes, springs, and miscellaneous data-collection sites; (2) water-level measurements in 48 observation wells; (3) lithologic and geophysical logs of 367 test holes and wells; (4) 273 chemical analyses of ground water; (5) 33 chemical analyses of surface water during low flow; (6) 18 chemical analyses of ground water for trace constituents; (7)9 chemical analyses of ground water for dissolved gases; (8) 62 analyses of core samples for hydraulic parameters and particle-size distribution; and (9) 29 analyses of core samples for heavy mineral content. (USGS)
W81-00158

GROUND-WATER RESOURCES OF DICKEY AND LA MOURE COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
C. A. Armstrong.
North Dakota County Ground-Water Studies 28--Part III, and North Dakota Geological Survey Bulletin 70-Part III, 1980. 61 p, 18 Fig, 2 Plates, 3 Tab, 47 Ref.

Descriptors: *Groundwater resources, *North Dakota, *Aquifer characteristics, *Water yield, *Water quality, Water supply, Chemical properties, Groundwater availability, Hydrogeology, Water wells, Data collections, Water level fluctuations, Groundwater recharge, Transmissivity, Maps, Hydrographs, Water utilization, Dickey County(ND), LaMoure County(ND).

Ground water in Dickey and LaMoure Counties, ND., is obtained from Glacialdrift aquifers of Quaternary age, the Pierre, Newcastle, and Lakota-Fall River aquifers of Cretaceous age, and the Black Island aquifer of Ordovician age. The major glacial-drift aquifers, at depths of 0 to 304 feet, will yield as much as 1,500 gallons per minute of water containing 248 to 1,890 milligrams per liter dissolved solids. The Pierre aquifer generally yields less than 5 gallons per minute to wells. The water contains from 1,400 to 8,630 milligrams per liter dissolved solids. The Newcastle aquifer system, is at depths ranging from 790 to somewhat more than 2,000 feet, and is separated into two aquifers. Well yields generally are less than 80 gallons per minute. Dissolved-solids concentrations range from 2,060 to 4,590 milligrams per liter. The Lakota-Fall River aquifer, at depths of 1,100 to 2,200 feet, locally should yield as much as 1,000 gallons per minute. Dissolved-solids concentrations range from 2,030 to 4,850 milligrams per liter. The Black Island aquifer, at depths from 1,421 to 3,000 feet, contains water that has 2,520 and 3,800 milligrams per liter dissolved solids. (USGS)
W81-00159

DESIGN IS THE KEY TO A GOOD RECHARGE WELL,
UOP, Inc., St. Paul, MN. Johnson Div.
A. J. Smith.
Public Works, Vol 111, No 10, p 66-67, October, 1980. 2 Fig.

Descriptors: *Artificial recharge, *Recharge wells, *Design, *Injection wells, *Injection, Induced infiltration, Pore water, Well screens, Thermal properties, Head loss, Groundwater recharge.

A recharge well located near Grand Island, Nebraska is described which was pumped continuously at a rate of 750 gpm for 6 months. The use of injection water which was nearly sand free is credited with the long-lasting period of pumping. Designing a sand-free well requires sizing of the screen slot in accord with established standards of natural development or gravel packing. The well must be able to recharge at a rate equal to the production rate. The screen must also take full advantage of the aquifer characteristics. The diameter of the well is an important factor which is often determined by the size of the pump selected to be installed. Accurate placement of the screen in the permeable zones is a vital step in design of the well. In injection wells it is often recommended that large parts of the aquifer be screened as opposed to only the most productive parts. Problems such as plugging due to air entrainment, precipitates, and bacteria and thermal interference are discussed. (Baker-FRC)
W81-00243

4C. Effects On Water Of Man's Non-Water Activities

HYDROLOGICAL AND ENVIRONMENTAL CONTROLS ON WATER MANAGEMENT IN SEMIARID URBAN AREAS,
Arizona Water Resources Research Center, Tucson.
S. Resnick, and K. J. DeCook.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-109704, Price codes: A05 in paper copy, A01 in microfiche. Project Completion Report, September, 1980. 70 p, 14 Fig, 19 Tab, 7 Ref, Append. OWRT B-012-ARIZ (6), 14-31-0001-3056.

Descriptors: Urbanization, Water management(Applied), Water reuse, *Urban runoff, *Semiarid climates, *Water pollution sources, *Water treatment, *Rainfall-runoff relationships, Small watersheds, Arizona.

Rainfall and runoff studies initiated in 1968 by the University of Arizona provide data for three small urban watersheds with different land use patterns in Tucson, AZ. Annual precipitation of about 11 inches produces annual runoff, as measured at outflow flumes, ranging from 1.30 to 3.95 inches, produced by 15 to 23 runoff events per year. About 60 to 70% of the annual runoff events occur in the summer season, as does 65 to 75% of the annual volume of measured runoff. Water samples collected on a lumped basis show generally high concentrations of suspended sediment, bacterial loading, and dissolved organics. Initial field treatment and exploratory laboratory studies of treatment methods indicate that three days is an optimal length of time for detention storage of runoff, reducing average pollutant concentrations to 62 mg/1 of turbidity, total coliform of 70-3200 organisms per 100 mg/1, and 7 mg/1 of chemical oxygen demand. Simple laboratory treatment with alum and polyelectrolyte yielded an 80% reduction in COD, 90% reduction in bacterial loading, and appreciable clarification of the runoff samples. Continuing research should be conducted to utilize a longer data record for improving understanding of rainfall-runoff relations; to use distributed sampling within individual watershed areas to define specific pollutant source areas; and to incorporate economic and legal questions involved in the utilization of urban runoff in an arid area.
W81-00006

EFFECTS OF URBAN RUNOFF AND WASTEWATER EFFLUENT ON WILSONS CREEK AND JAMES RIVER NEAR SPRINGFIELD, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
W. R. Berkas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-201775, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-27, March 1980. 31 p, 15 Fig, 4 Tab, 10 Ref.

Descriptors: *Water pollution effects, *Urban runoff, *Municipal wastes, *Water quality, *Missouri, Effluents, Water pollution sources, Streamflow, Rainfall, Storm runoff, Flood frequency, Hydrologic data, *Wilsons Creek(MO), *James River(MO), *Springfield(MO).

Statistical analysis on water-quality parameters from James River upstream and downstream from the confluence of Wilsons Creek shows a significant difference for all parameters except temperature and dissolved silica at the 0.05 probability level. Regression analysis shows correlation for discharge with dissolved sodium, dissolved chloride, and dissolved potassium, and for specific conductance with dissolved chloride and dissolved sulfate at the station downstream from Wilsons Creek. This is due to the consistent quality of the effluent from the Southwest Wastewater Plant on Wilsons Creek. Water-quality monitor stations upstream and downstream from the wastewater plant indicate that the plant has a degrading effect on dissolved oxygen in Wilsons Creek and James River. The monitors also indicate that rainfall flushes momentarily poor quality water into Wilsons Creek from the urbanized Springfield area. Overall, the runoff is diluting the effluent from the wastewater plant. Rainfall and runoff stations indicate a rapid response of runoff to rainfall due to the high percentage of imperviousness and the filling or paving of sinkholes. (USGS)
W81-00065

THE INFLUENCE OF URBANIZATION ON THE AQUEOUS TRANSPORT AND DISTRIBUTION OF HEAVY METALS IN THE SADDLE RIVER,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5B.
W81-00099

THE MANGROVE SWAMP - AN ECOSYSTEM IN DANGER,
Swedish Water and Air Pollution Research Lab., Stockholm.
O. Linden, and A. Jernelov.
Ambio, Vol 9, No 2, p 81-88, 1980. 7 Fig, 42 Ref.

Descriptors: *Mangrove swamps, *Land forming, *Erosion control, *Coasts, *Soil stabilization, Flood control, Vegetation establishment, Marine animals, Life cycles, Ecology, Ecosystems, Tropical regions, Water pollution effects, Thermal pollution, Herbicides, Land reclamation, Land development.

Coastal mangrove swamp ecosystems are becoming threatened by pollution and land reclamation. Mangrove swamps exist in tropical areas with high

year-round precipitation usually between the high and low tide marks and often form the boundary between oceans and tropical forests. Mangrove environs are characterized by a thick layer of very loose organic soil which is anaerobic just below the sediment surface; this soil is partly formed by the detritus of the mangroves and silt that is washed in and held by the mangrove swamps. The accumulation of sediments and detritus and the growth of widespread root systems to accommodate the loose, anaerobic soil contribute to rapid land formation by mangrove swamps and also provide significant erosion protection. Various flora and fauna ecosystems are associated with mangrove swamps and some organisms are dependent upon mangroves for shelter as well as food during larval and juvenile stages of development. Mangroves are highly susceptible to herbicides and thermal pollution and grow in areas frequently exposed to oil contamination. The mangrove swamps are also impacted by land reclamation activities and by harvesting; these activities have led to flooding and the destruction of other forms of vegetation. (Lisk-FRC)
W81-00206

UNDERGROUND DERELICTION IN THE NORTH WEST,
J. G. Lloyd.
Water Services Vol 8, No 1014, p 519-520, 523-524, 527, August, 1980. 4 Fig.

Descriptors: *Underground structures, *Urbanization, *Water resources development, *History, *Water districts, Sewers, Sewerage, Water pollution, Industrial wastes, Storm drains, Local governments, Costs, Overflow, Repairing, Construction, Collapse.

The development of sewage drainage systems and water supplies in the industrial northwest of England (including the cities of Liverpool and Manchester) is described. With the rapid industrialization of the first half of the 19th century, wells, springs and rivers rapidly became polluted from overloaded and piecemeal drainage systems. By the 1840s, major contributions were looking beyond their boundaries for unpolluted water, and by 1850 a series of catchment reservoirs was established in the Pennine hills. However, until 1974, 58 separate local authorities managed the sewers and sewage disposal in the area of Greater Manchester County. Since then, water supplies have been managed on a regional basis. In the early 1800s, various types of design and construction were used to build the surface water sewers, and most of these early sewers were built of poor quality soft bricks. Many sewers and old water mains need to be replaced on a large scale due to unsatisfactory forms of construction, decrepit structural condition, inadequate carrying capacity, and inappropriate location. Flooding by sewage in streets and homes, underground decay causing sewer collapses, and the proliferation of storm sewage overflows from sewerage system to watercourses, point to the need for restructuring and repairing existing systems rather than simply repairing collapses. Financial assistance from the national government will be necessary to repair underground dereliction while at the same time further developing water resources and reducing pollution. (Baker-FRC)
W81-00233

4D. Watershed Protection

SEDIMENT-TRAP EFFICIENCY OF A MULTIPLE-PURPOSE IMPOUNDMENT, NORTH BRANCH ROCK CREEK BASIN, MONTGOMERY COUNTY, MARYLAND, 1968-76,
Geological Survey, Harrisburg, PA. Water Resources Div.
W. J. Herb.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.50. Geological Survey Water-Supply Paper 2071, 1980. 41 p, 19 Fig, 11 Tab, 19 Ref.

Descriptors: *Sediment control, *Trap efficiency, *Storm runoff, *Multiple-purpose reservoirs, *Maryland, Small watersheds, Urbanization, Land use, Stream flow, Flo characteristics, Suspended load, Bed load, Sediment transport, Sediment yield, Particle size, *Noth Branch Rock Creek basin(MD), *Montgomery County(MD).

Lake Bernard Frank, a multiple-purpose reservoir in Montgomery County, Md., impounds runoff and sediment from 12.5 square miles of the upper North Branch Rock Creek basin. A U.S. Geological Survey study between 1967 and 1976 measured a sediment-trap efficiency of 96 percent for the impoundment. The impoundment's capacity-inflow ratio of 0.37 indicates a theoretical trap efficiency of 95 percent. Suspended-sediment outflow from the impoundment was measured as 5,910 tons for the 1968-76 water years. A total sediment inflow of 136,000 tons was estimated for the same priod. The inflow estimate was based on measured inflow, inflow computed from daily sediment-transport curves, inflow computed from land-use/land-cover sediment-yield relationships, and empirical bedload equations. Discharge-weighted percentages of sand, silt, and clay averaged 16, 50, and 34 percent upstream from the impoundment and were zero, 16, and 84 percent below the reservoir. Average streamflow conditions and recent sediment yields indicate the total sediment-pool capacity will be filled in 27 more years, or by the year 2003. (USGS)
W81-00060

DEVELOP WATER MANAGEMENT METHODS FOR WATERSHEDS SUBJECT TO INTENSIVE DEVELOPMENT,
Arizona Univ., Tucson. Water Resources Research Center.
J. Ben-Asher, M. Diskin, U. Kafri, S. D. Resnick, and M. Sneidovich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113318, Price codes: A03 in paper copy, A01 in microfiche. Partial Project Completion Report, September, 1980. 28 p, 6 Fig, 8 Tab, 13 Ref. OWRT-A-069-ARIZ(4), 14-34-0001-6003.

Descriptors: *Model studies, *Hydrologic budget, Water balance, *Equations, *Watersheds(Basins), *Water management(Applied), Hydrology, Hydrologic systems, Hydrologic properties, Mathematical studies, Rational formula, Groundwater basins, Groundwater, Water quality, Chemical analysis, Evapotranspiration, Basins, Runoff, Lakes, Mathematical models, Engineering, Hydrologic aspects.

Assessment was made that a model of the hydrologic system is the only possible link between the hydrologist and the systems engineer in dealing with water management methods for watersheds potentially subject to intensive future development, as exemplified by the Sonoita Creek Basin in Arizona. The water balance picture taken by the hydrologist must be advanced to where the response will be known of the considered aquifer to different water policies. From this point, integration of the environment with its management can be properly addressed. An appropriate model is the overall goal of a hydrologists' study, since it will enable him to simulate relationships between recharge, discharge, and groundwater elevation. Hence, a water balance model was calibrated, and a working routine was developed with the model that was used by the systems engineers. Water balance equations consider Basin precipitation, groundwater underflow into the Basin, Basin evapotranspiration, evapotranspiration from the lake and vegetation strip, groundwater outflow from the Basin, groundwater inflow into the lake and vegetation strip, groundwater recharge, runoff, and change in soil and groundwater storage. Groundwater quality was determined by standard chemical analysis (plus iron, copper, zinc, and lead) on well water samples. (Zielinski-IPA)
W81-00115

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

SEPTIC TANK DRAINFIELD FAILURES RESULTING FROM MINERALOGICAL CHANGES,
Virginia Polytechnic Inst. and State Univ., Blacksburg, VA. Dept. of Agronomy.
L. W. Zelazny, D. A. Lietzke, and H. L. Barwood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-114662, Price codes: A07 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University Bulletin 124, September 1980, 118 p, 71 Fig, 19 Tab, 36 Ref. OWRT A-079-VA(1).

Descriptors: *Septic tank drainfield failures, *Mineralogical changes, *Soils, *Groundwater, Water pollution, Wastewater, Waste disposal, Sewage, Chemical analysis, Cation exchange, Water analysis, Soil analysis, Analytical techniques, *X-ray diffraction.

The purpose of this study was to determine whether septic tank drainfield failures in areas containing soils with a high biotite or chloritized vermiculite component could be the result of mineralogical changes that decrease the permeability of the soil at the drainfield interface. Twenty-four drainfields in 5 Virginia counties were examined. Soil samples were taken at 16 sites and examined in the laboratory for chemical and mineralogical changes. Visible alterations were detected at the soil-drainfield interface, and all systems examined showed some chemical change. X-ray diffraction analysis revealed a mineralogical change in 12 sites, with 6 of these sites showing distinct change, consisting primarily of the conversion of vermiculite chlorite intergrade into vermiculite and sometimes some montmorillonite, with some dissolution of kaolinite. Soil samples from sites with significant vermiculite chlorite intergrade content showed an increase in the sum of exchangeable bases at the soil-drainfield interface, apparently linked to interlayer removal and vermiculite formation. The exchange complex of the soil at the drainfield interface was selective for calcium and sometimes magnesium and was not dominated with sodium, which was high in the effluent. Samples from some sites did show an increase in organic matter at the interface. However, the increase was not considered sufficient to cause a reduction of flow in the drainfield. Field examinations of the soils revealed that the primary mode of effluent movement was channelized flow. At no site did the drainfield fail for purely mineralogical reasons. However, the changes detected could contribute to the eventual failure of the system by decreasing soil permeability, especially in soils with initial low permeability.
W81-00004

DEVELOPMENT AND EVALUATION OF ELECTROANALYTICAL METHODS FOR DETERMINATION OF METAL-ION CONCENTRATIONS IN WATER.
West Virginia Univ., Morgantown. Water Research Inst
J. H. Strohl, B. Bezilla, R. Romanosky, and J. T Maloy
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-110736, Price codes: A02 in paper copy, A01 in microfiche. Technical Completion Report 1980. 18 p, 4 Fig, 2 Ref. OWRT-A-035-WVA (1), 14-34-0001-0852.

Descriptors: Analysis, Analytical techniques, *Electrochemistry, *Methodology, *Trace elements, *Water analysis, Anodes, Chemical analysis, Electrodes, Electrolysis, Evaluation, Metals, Mine water, Water pollution, Water quality, Silver, Copper, Cadmium, Zinc.

This study was directed toward the development of electrochemical procedures that would be suitable for the on-site determination of the concentra-

tions of some metal ions and halide ions. The methodology was based on semi-integral analysis for the qualitative identification and on stripping analysis for the quantitative determination of metal ions. Of the three electrode systems developed as a part of this project, two systems were found to be suitable for portable use. The overall system was found to be capable of determining silver, copper, cadmium, and zinc (Ag(+), Cu(2+), Cd(2+), and Zn(2+)) concentrations as low as 0.08 parts per million (ppm), chloride as low as 0.35 ppm, and ferrous iron (Fe(2+)) and ferric iron (Fe3+)) at the 0.3 ppm level.
W81-00013

PRODUCTIVITY OF GREAT LAKES ZOOPLANKTON,
Ohio State Univ., Columbus. Dept. of Zoology.
D. A. Culver.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-109829, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, Ohio State University Project Completion Report No 710799-760851, May 1980, 60 p, 14 Fig, 8 Tab, 30 Ref, 3 Append. OWRT-A-048-OHIO (1).

Descriptors: *Great Lakes, *Zooplankton, *Productivity, Cladocera, Copepoda, Rotifera, Lake Erie, Lake Ontario, Toxicity, Non-ionic detergents, Forecasting, Growth rates, *Mathematical models.

A mathematical model of zooplankton productivity for the Laurentian Great Lakes has enabled us to calculate productivity rates for Cladocera, Copepoda, and Rotifera from Lakes Ontario and Erie. Productivity values from the Bay of Quinte, Lake Ontario, demonstrated that nearshore productivity and biomass varied greatly along with algal abundance and temperature. A study of 30 stations in Lake Erie on 10 monthly cruises showed that total productivity of the zooplankton community is strongly correlated with temperature, but that individual taxa varied significantly throughout the season. Productivity in the open water of Lake Erie (1970) was much less than the values observed in the Lake Erie and Lake Ontario nearshore zones. Comparison of the roles of Copepoda, Cladocera, and Rotifera in the over-all productivity showed that Copepoda predominated in the spring, along with rotifers, but that Cladocera were the most important producers during the summer. Measurements of cladoceran size at first reproduction showed that they reach maturity at a large size in the spring and decline in size at maturity through the summer, with all species declining in size in a synchronous pattern. It is suggested that this pattern results from the combined effects of size-selective predation by fish and competition among cladocerans for food.
W81-00017

DEVELOPMENT OF A SIMPLE MEANS FOR PREDICTING ALGAL BLOOMS,
Syracuse Univ., NY. Dept. of Civil Engineering.
S. Litten, S. W. Effler, and M. Meyer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112625, Price codes: A04 in paper copy. Technical Completion Report, September 1980. 53 p, 22 Fig, 16 Tab, 19 Ref. OWRT-B-087-NY (1), 14-34-0001-9086.

Descriptors: *Algae, *Algal control, Algicides, Biomass, Algal blooms, Color, Copper sulfate, *Lakes, Reservoirs, Phytoplankton, Chlorophyll, Indicators, Predicting algal blooms, New York, Syracuse area(NY).

A simple technique to predict the future occurrence of algal blooms was evaluated for seven test lake systems proximate to Syracuse, NY during the summer of 1978 and 1979. The selected test systems represent a broad range of trophic status, from mesotrophic to hypereutrophic. The technique includes a simple filtering process followed by the identification of the color imparted to the filter, based on comparison to National Bureau of Standards' color chips. The reference measure of phytoplankton standing crop was chlorophyll-a. Particular colors of filtered particulates were not demonstrated to be useful estimators of chlorophyll-a concentration, though the hues olive and yellow- green were associated with higher chlorophyll-a levels. In several of the lakes particulate lightness and color saturation were significant estimators of chlorophyll-a. In addition, the particulate color method was demonstrated to be useful in following certain physical/chemical changes in a lake.
W81-00018

TESTS OF TWO FLUOROMETRIC ASSAYS FOR GONYAULAX AND APHANIZOMENON TOXINS,
New Hampshire Univ., Durham. Dept. of Biochemistry.
P. W. Carter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112740, Price codes: A04 in paper copy. Master of Science Thesis, 1980. 43 p, 14 Fig, 3 Tab, 36 Ref. OWRT-A-047-NH (4), 14-34-0001-8031.

Descriptors: *Bioassay, *Assay, *Shellfish, *Toxins, *Red tides, Analytical techniques, Fluorometer, Dinoflagellates, Poisons, Blue-green algae, Algae blooms, *Solution fluorometric assay, Paralytic shellfish poisoning, Algae extracts, Column fluorometric assay, Aphanizomenon flos-aquae, Column chromatography, Spectrofluorometer, Food poisoning.

The purpose of this research was to further test two assay procedures with shellfish extracts and with A. flos-aquae cells: a solution fluorometric assay and a column chromatography assay using Dowex AG-50W-X4, a sulfonic acid cation exchange resin, both developed by Shoptaugh. The assays were also tested to see if an inexpensive filter fluorometer could be used instead of the spectrofluorometer used in developing the assays. Attempts were also made to clean up the shellfish extracts by column chromatography in order to improve the sensitivity of the assay when used with the filter fluorometer. The research demonstrated that the solution fluorometric assay for PSP in shellfish gives results which are comparable to the mouse assay for shellfish of high toxicity and which are possibly more accurate than the mouse assay for shellfish of low toxicity. The assay, therefore, merits consideration for the routine monitoring of toxicity of shellfish. It was also shown that the assay was ineffective when a less expensive filter fluorometer was used in place of a spectrofluorometer. Attempts to modify the assay for use with a filter fluorometer were unsuccessful, but the problems encountered with the chromatographic clean-up of the extracts do not seem to be insurmountable. It is likely, therefore, that the assay could be adapted for use with a filter fluorometer. The column fluorometric assay appeared to be in applicable to shellfish extracts, a finding which contradicts Shoptaugh's data. However, this assay did appear to be of some use when applied to extracts of the blue-green alga Aphanizomenon flos-aquae.
W81-00020

EFFECTS OF A HEPATIC TOXIN FROM THE CYANOPHYTE, MICROCYSTIS AERUGINOSA,
New Hampshire Univ., Durham. Dept. of Zoology.
T. L. Foxall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112708, Price codes: A06 in paper copy. Ph.D. Thesis, 1980. 107 p, 17 Fig, 2 Tab, 55 Ref, 1 Append. OWRT-A-047-NH (3), 14-34-0001-8031.

Descriptors: *Toxins, *Cyanophyta, *Blue-green algae, Poisins, Microorganisms, *Eutrophication, Lakes, Ponds, Evironmental effects, Ecosystems, *Hepatic toxin, *Microcystis aeruginosa, *Cyanobacteria, *Microcystin, Freshwater blooms, Liver damage, Blooms.

Toxic cyanobacteria bloom in eutrophic, freshwater lakes and ponds and may cause environmental, health and recreational problems during or after the massive growth of these microorganisms. Microcystis aeruginosa is commonly involved in freshwater blooms and one of its toxins (microcystin) causes liver damage in birds and mammals. This sutdy has determined the specific site of action of microcystin and characterized the hepatic damage at the ultrastructural level. Histological changes in centrilobular regions of liver tissure were noted after intraperitoneal administration in mice. Hepatic sinusoidal epithelial and hepatocyte plasma membranes ruptured with the release of cellular components that pooled with blood. Mitochondria appeared swollen but there were no obvious distortions of other organelles. Extensive vesiculation of membrane fragments was observed. Hepatic damage caused massive hemorrhaging into the liver where blood and cell debris accumulated and produced a significant increase in liver weight. Primary cultures of hepatocyte microexplants from pre- and postnatal mice and rats were exposed to microcystin but in vitro effects were not observed. In vitro experiments showed that young animals were not sensitive to the toxin but developed sensitifity as they matured. Microcystin was shown to be very specific in its site of action since it had no antiplanktors, crustacea, amphibians and teleosts. Electrical or mechanical activity in isolated nerve, nerve-muscle and cardiac preparations also was not effected. Toxins came from cultured cells and naturally occurring blooms and gave identical results in all experiments.
W81-00026

A TRIHALOMETHANE STUDY OF THE DURHAM, NEW HAMPSHIRE WATER TREATMENT PLANT,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
K. M. Stewart.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-110363, Price codes: A04 in paper copy, A01 in microfiche. Master of Science, 1978. 62 p, 5 Fig, 8 Tab, 14 Ref, 3 Append. Plan 'B' Paper. OWRT-A-048-NH (1), 14-34-0001-8031.

Descriptors: *Water treatment, *Chemical analysis, *Organic compounds, *Chlorination, New Hampshire, Separation techniques, Finished water, Raw water, *Trihalomethane, *Chloroform, *Bromodichloromethane, Liquid-liquid extraction, Synthetic organic chemicals, Carcinogens, Durham(NH).

This study quantified the levels of chloroform and bromodichloromethane in the finished water from the water treatment plant in Durham, New Hampshire and investigated the effects of temperature, contact time, and point of chlorination on the levels of these compounds found in the finished water. Finished water samples were collected during April 1978, stored under controlled conditions and analyzed for trihalomethanes by gas chromatography utilizing the liquid-liquid extraction technique. Test results indicated that while the raw water contained no detectable trihalomethanes, chloroform was present in the finished water in concentrations ranging from 9 mg/1 to 170 mg/1 depending upon storage temperature, contact time, and point of chlorination. Bromodichloromethane was also present in the finished water but at very low concentrations (2 - 10 mg/1). Dibromochloromethane and bromoform were not detected. Reductions of average total trihalomethane concentrations as high as 27% were achieved by simply changing the point of chlorination from raw water to settled water.
W81-00033

RAPID DETERMINATION OF BACTERIAL WATER QUALITY THROUGH IMPROVED COLIFORM TEST PROCEDURES,
Northern Arizona Univ., Flagstaff. Dept. of Microbiology.
H. K. Speidel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113060, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, September 1980. 10 p. OWRT-A-093-ARIZ(1), 14-34-0001-9003.

Group 5A—Identification Of Pollutants

Descriptors: *Coliforms, *Water analysis, *Analytical techniques, *Testing procedures, Water quality, Aquatic bacteria, Microbiology, Sewage bacteria, Microorganisms, E. coli, Gas chromatography, Alcohols, Testing, Laboratory tests, Quality control, Membranes, Filtration.

Several innovative methods were investigated as potential rapid methods for the determination of coliform bacteria in domestic water. A literature survey and laboratory experiments were conducted to critically evaluate the limitations of current membrane filtration methodology for the determination of total coliform bacteria. Several approaches were made to develop media with improved selection/differentiation properties. Tergitol agar, not recommended for recreational water analysis, may be useful for potable water evaluations due to its desirable recovery characteristics. Bromthymol blue produced detectable coloration of colonies grown in six hours of incubation, but low reliability of differentiation between coliform and non-coliform colonies was observed. Finally, a gas chromatographic analysis method was examined, based on the determination of ethanol from ethanol-producing coliform bacteria in water. The method was found to be applicable to the determination of ethanol-producing coliform bacterial concentrations ranging from 2-2000 organisms per 100 ml of water within 12 hours of culture incubation. While the methods studied are not sufficient to substitute for conventional coliform assays, further work and refinement of innovative approaches was encouraged in order that a more rapid determination of bacterial water quality might be attained. (Zielinski-IPA)
W81-00075

CHANGES IN PHOSPHORUS CONCENTRATIONS DUE TO MIXING BY MOTORBOATS IN SHALLOW LAKES,
University of Central Florida, Orlando. Engineering and Industrial Experiment Station.
For primary bibliographic entry see Field 2H.
W81-00100

RAPID ANALYSIS OF ORGANIC POLLUTANTS IN SURFACE WATERS BY HIGH-PRESSURE LIQUID CHROMATOGRAPHY,
Wisconsin Univ.-Madison. Water Resources Center.
K. Huibregtse, and J. M. Harkin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-116881, Price codes: A03 in paper copy, A01 in microfiche. Technical Report WIS WRC 80-08, 1980. 32 p, 16 Tab, 9 Ref. OWRT-A-069-WIS(2), 14-34-0001-6052, 14-34-0001-7105, 14-34-0001-7106.

Descriptors: Pollutants, *Organic compounds, *Chromatography, Analytical techniques, *Water analysis, Water pollution sources, *Surface waters, Analysis, *Pollutant identification, Chemistry, Evaluation, Estimating, Instrumentation, Research and development, Testing, Testing procedures, Chemical analysis, Graphical analysis, Water pollution, Assay, Sampling, Water sampling, Correlation analysis.

A procedure was developed for the concentration and separation of nonpolar organic compounds from water samples using reversed-phase high-pressure liquid chromotography (HPLC) with trace enrichment. Using this procedure, a filtered water sample (30-1000 ml) was passed through an HPLC precolumn containing Porasil C-18, which was then coupled to a high-efficiency micro-Bondapak C-18 analytical column for HPLC separation and fingerprinting of the concentrated aqueous organics. An alternate method, used for fingerprinting of organics associated with suspended sediments, used a vacuum aspirator to pass unfiltered river bottom water samples through a teflon Poracil C-18 cartridge containing end filters, with dissolved organics concentrated on the C-18 and particulate/colloidal-bound organics on the filters. HPLC fingerprints were obtained on samples collected from various waterways, and fingerprint comparisons were made by determining the percentage of peaks present in one chromatogram that were also present in another. A high percent similarity indicated little change occurred in river flow quality between two sample collection points; a low percent similarity indicated major changes in waterway organics, suggesting influx of contaminants from a point source. Analysis of river bottom sediment samples was recommended over conventional water samples to locate the source of a large hazardous chemical spill. (Zielinski-IPA)
W81-00108

SOURCES AND BEHAVIOR OF NATURAL RADIOACTIVITY IN FALL LINE AQUIFERS NEAR LEESVILLE, SOUTH CAROLINA,
South Carolina Univ., Columbia.
J. Michel, and W. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-116840, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute, Clemson University, Clemson, South Carolina. Technical Report No 83, Februar, 1980. 73 p, 17 Fig, 11 Tab, 46 Ref. OWWR-B-116-SC(1), 14-34-0001-8115.

Descriptors: *Radium radioisotopes, *Radioactivity, *Isotope studies, *Water pollution sources, *Aquifers, *Groundwater, Water pollution treatment, Radioisotopes, Radiochemical analysis, Soil contamination, Radioactive wastes, South Carolina, Background radiation, Groundwater reservoirs, Water quality, Water management(Applied), Groundwater management, Potable water, Environmental control, Radioactivity effects, Water quality standards.

This project sought to determine the sources, behavior and controls of the radioactive Ra-226 and Ra-228 content of groundwater along the Fall Line of South Carolina; to understand the mechanisms for groundwater acquisition of radium; and to identify the sources and mode of occurrence of the uranium and thorium materials in the aquifer sediments. Groundwater from the Coastal Plain aquifers along the Fall Line near Leesville, South Carolina, had unexpectedly high radium activities, with Ra-228 an important part of the total, a Ra-226 content varying from 3.5-23.0 pCi/liter a radium 228/226 activity ratio among Leesville city wells from 0.23-3.0 (constant for a single well over time), and a total radium content of these wells from 10.8-29.7 pCi/liter. The high Ra-228 may affect the EPA interim drinking water standards for radium. Manganese-impregnated fibers can be used for technically/economically feasible treatment for radium isotopes removal. High Rm-222 was observed, 250-7750 pCi/liter, in Piedmont rock well groundwaters, suggesting a potential health hazard from high radon by out-gassing at the faucet. It is concluded that, while sufficient groundwater exists for doubling the present groundwater use by Leesville, groundwater treatment must be exercised for radium removal or dilution. (Zielinski-IPA)
W81-00113

MODELING OF HEATED SURFACE JETS,
State Univ. of New York at Buffalo. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 5B.
W81-00114

A RE-EVALUATION OF LEAD-210 CHRONOLOGY AND THE HISTORY OF TOTAL LEAD INFLUX IN A SMALL SOUTH BELGIAN POND,
Liverpool Univ. (England). Dept. of Geography.
F. Oldfield, P. G. Appleby, and D. Petit.
Ambio, Vol 9, No 2, p 97-99, 1980. 4 Fig, 1 Tab, 21 Ref.

Descriptors: *Lead, *Lake sediments, *Dating, *Mathematical models, *Pollutant identification, History, Pollutants, Water pollution, Analytical techniques, Graphical analysis, Bottom sampling, Sampling, Cores, On-site data collection.

Recent sediments from Lake Mirwart, south Belgium were studied along with sediments from other lakes in Northern Ireland, New Guinea, and Finland by stratigraphic and radiometric means to evaluate a model of lead-210 dating at the site. This model is based on the assumption of a constant net rate of supply of unsupported lead-210 to the sediment despite variations in dry mass sedimentation rates within and between cores. Changes in lead concentration and net flux to the sediment from about 1890 AD were calculated by applying the age/depth curves and sedimentation rates derived from the model to stable isotope lead analyses from three Lake Mirwart sediment cores. A dramatic acceleration was found in anthropogenic lead flux during the present century with an especially sharp increase from about 1950 on. These findings were compared with sedimentary and botanical records of lead pollution history from Lake Michigan and southern Scandinavia. It was concluded that lead-210 dating in appropriate situations may provide support for pollution calculations. (Baker-FRC)
W81-00205

SAMPLING PROGRAMME DESIGN FOR WATER QUALITY IN DISTRIBUTION,
Yorkshire Water Authority (England). Office of Scientific Services.
C. S. Short.
Water Services, Vol 84, No 1014, p 529-530, 533-534, 537, August, 1980. 3 Fig, 4 Tab, 1 Ref

Descriptors: *Water quality, *On-site data collection, *Water analysis, *Sampling, Optimization, Statistical methods, Water distribution(Applied), Management, Methodology, Frequency analysis, Domestic water, Project planning, Potable water, Design

A procedure for the design of a potable water supply sampling program is proposed, based on identification of management needs and cost-effective use of scientific resources. The program includes statistical analysis of data at the inception of sampling in order to minimize the total amount of samples required and to achieve randomness in the selection of samples. Mathematical treatment of the data includes fitting an appropriate frequency distribution and determining the precision required to meet management-defined objectives. Formulas for computing number of samples and confidence levels are presented. A reporting format for parameters with short-term variations such as turbidity and pH is presented. The procedure was developed in a pilot program. (Titus-FRC)
W81-00232

5B. Sources Of Pollution

HYDROLOGICAL AND ENVIRONMENTAL CONTROLS ON WATER MANAGEMENT IN SEMIARID URBAN AREAS,
Arizona Water Resources Research Center, Tucson.
For primary bibliographic entry see Field 4C.
W81-00006

WATER QUALITY TRANSFORMATIONS AND GROUNDWATER RECHARGE OF SEWAGE EFFLUENT RELEASES IN AN EPHEMERAL STREAM CHANNEL,
Arizona Univ., Tucson. Dept. of Civil Engineering.
S. Ince, R. A. Phillips, and L. G. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112724, Price code: A02 in paper copy. Project Completion Report, 1980, 20 p, 7 Fig, 5 Tab, 7 Ref OWRT A-051-ARIZ (2), 14-31-0001-5003

Descriptors: *Ephemeral streams, *Open channel flow, *Physicochemical properties, *Groundwater recharge, Southwest U.S., Sewage effluents, Path of pollutants, Water quality, Streamflow, Flow rates, Arizona, Santa Cruz River(AZ)

Bio-physicochemical measurements were made on treated sewage effluent releases at established locations within the channel of an ephemeral stream, the Santa Cruz River of Southern Arizona. Water samples were taken in chronological sequence as the effluent moved downstream, to trace changes in quality parameters during low and high hydrograph stages. Results indicate that dissolved

oxygen (DO) concentrations at low effluent flows were higher than DO concentrations at high effluent flows; while, conversely, biochemical oxygen demand (BOD) concentrations at low effluent flows were generally lower than BOD concentrations at high effluent flows. Biochemical oxygen demand concentrations are affected by waste loadings, flow conditions, phytoplankton growth and nitrification. Mean river deoxygenation rates (kr) in sewage flows after six river miles from the Tucson Sewage Treatment Plant were always negative or increasing, indicative of nitrification, algal growth, and concentration of organic constituents through seepage losses.
W81-00019

WATER DISTRIBUTION AND MOVEMENT IN AN UNSATURATED PIEDMONT SOIL PROFILE,
Clemson Univ., SC. Dept. of Agricultural Engineering.
J. T. Ligon, T. V. Wilson, J. F. Allen, T. G. King, and U. P. Singh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113995, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute, Clemson University Report No 82, 1980, 103 p, 44 Fig, 4 Tab, 28 Ref, 3 Append. OWRT-A-023-SC (9).

Descriptors: *Unsaturated flow, *Soil moisture, *Tritum, Radioactive tracers, Percolation, Water table, *Soil water movement, Groundwater recharge, Tracers, Model studies, Seepage, Root zone, Soil types, *Path of pollutants, Piedmont, South Carolina.

The purpose of the study was to further investigate the deep seepage - groundwater recharge phenomenon, to develop models of the deep seepage process and to examine moisture displacement in the profile as it relates to the transport of pollutants from the soil surface downward to the groundwater. The study consisted of field investigations and model development. Field investigations include soil moisture and water table measurements, observations of surface runoff and interflow, and a radioactive tracer study. Two computer programs were written using the IBM simulation language CSMP. In one, called the Root Zone Model, precipitation and temperature data are used to estimate runoff, evapotranspiration and storage in the root zone. Any excess moisture is considered to perculate below the root zone as deep seepage. The second program, called the Deep Seepage model, uses the deep seepage calculated in the Root Zone Model and simulates its movement through the unsaturated zone to the pheatic surface, at a depth of 20m. In general, the Root Zone Model performed well, while the results of the Deep Seepage Model were biased towards an underestimate of the volume of moisture in the profile.
W81-00042

GREAT BLUE HERONS AS ENVIRONMENTAL INDICATORS: ASPECTS OF FORAGING ECOLOGY,
Ohio Cooperative Wildlife Research Unit, Columbus.
G. A. Grau, and R. Parris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113979, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, Ohio State University Project Completion Report No RF 760851-710800, June, 1980. 69 p, 16 Fig, 17 Tab, 51 Ref. OWRT-A-049-OHIO(1).

Descriptors: *Migratory birds, *Animal behavior, *Migration patterns, *Distribution patterns, *Lake Erie, Environmental gradient, Movement, Wading birds, Biorhythms, Migration, Nesting, Wildlife, Birds, Spatial distribution, Temporal distribution, Evaluation, *Great Blue Herons, Environmental indicators, Food chains.

A determination of the amount of seasonal and yearly variation in feeding site locations and the amount of overlap in feeding site locations for herons from the various southwestern Lake Erie region colonies was sought. Ten major feeding locations of Great Blue Herons were determined during this February-August 1977 and March-August 1978 study. Factors affecting heronry stratification, individual heron feeding sites, heron movement behavior, aggressive behavior at the feeding site, and heron populations at sites were included. Flight directions from all colonies were similar since most heron flights were contained within a few flight directions. Flight line patterns for the colonies were relatively constant over the season and between years, suggesting an overall fixed use of feeding areas. Although feeding sites for Sandusky Bay heron colonies overlap, herons of smaller colonies tended to avoid use of marshes around the larger colony. Herons from heronry sections used different flight directions to feeding areas, and flock members leaving the heronry tended to be from the same section; but flock members did not always feed in theme area. Further, the amount of time spent at the feeding sites varied greatly. (Zielinski-IPA)
W81-00044

MICROBIAL TRANSFORMATION OF KEPONE,
Maryland Univ., College Park. Dept. of Microbiology.
S. A. Orndorff, and R. R. Colwell.
Applied and Environmental Microbiology, Vol 39, No 2, p 398-406, February, 1980. 5 Fig, 1 Tab, 25 Ref. OWRT-B-034-MD(1).

Descriptors: *Halogenated pesticides, *Microbial degradation, Chemical analysis, *Marine microorganisms, *Waste water treatment, Pseudomonas, Public health, Organic pesticides, Pesticides, Toxins, Metabolism, Biotransformation, Virginia, Water pollution, Gas Chromatography, Mass spectrometry, Chlorinated hydrocarbons, Microbiology, Water pollution sources, Sewage bacteria, Microorganisms, *Kepone, *James River(VA).

Mixed bacterial cultures and a pure culture of Pseudomonas aeruginosa strain K03 were obtained by enrichment culture of water samples collected from the sludge lagoon at the waste water treatment plant at Hopewell, Virginia, where Kepone production had contaminated the James River to the mouth of the Chesapeake Bay. The K03 strain and an isolated mixed aerobic enrichment culture aerobically transformed the toxic chlorinated pesticide Kepone to monohydro-Kepone (MHK). Verification of the transformation was made by analysis of extracts by gas chromatography with electron capture detection, and gas chromatography coupled to electron-impact mass spectrometry. The K03 strain and the isolated mixed culture also produced about 16% and 4%, respectively, of dihydro-Kepone, as determined by co-chromatography using authentic standards. When compared to the pure and mixed cultures, reduced amounts of MHK were produced by James River sediment microorganisms. Kepone was not useable as a sole source of carbon/energy by any of the bacteria or mixed cultures studied. Kepone concentrations found in Baileys Creek sediment entering the James River was about 1000-2000 parts per million, comparable to that reported by the U.S. Environmental Protection Agency, mostly associated with organic matter and colloidal particles. (Zielinski-IPA)
W81-00048

RESULTS OF WATER QUALITY SAMPLING NEAR RICHTON, CYPRESS CREEK, AND LAMPTON SALT DOMES, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
L. A. Gandl, and C. A. Spiers.
Available from OFSS, Box 25425, Fed. Ctr., Denver, CO. 80225, Paper copy $5.25, Microfiche $5.00. Geological Survey Open-File Report 80-443, 1980. 18 p, 5 Fig, 4 Tab, 8 Ref.

Descriptors: *Water quality, *Sampling, *Surface waters, *Groundwater, *Mississippi, Chemical analysis, Chlorides, Path of pollutants, Hydrogeology, Aquifer characteristics, Radioactive wastes, Underground waste disposal, Evaluation, *Mississippi salt-dome basin, Salt domes.

In the Mississippi salt basin in southern Mississippi, chemical quality studies of surface water and ground water have been made to determine present water-quality conditions near three salt domes being studied by the Department of Energy as potential repositories for radioactive wastes. Chloride concentrations in excess of 60 milligrams per liter in surface water and ground water in Perry County indicate that contamination could be occurring from industrial wastes, oil test wells, or dissolution of Richton or Cypress Creek domes. (USGS)
W81-00053

HYDROLOGY AND WATER QUALITY OF THE LOWER MISSISSIPPI RIVER,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W81-00064

EFFECTS OF URBAN RUNOFF AND WASTEWATER EFFLUENT ON WILSONS CREEK AND JAMES RIVER NEAR SPRINGFIELD, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 4C.
W81-00065

RELATIONSHIPS OF DISSOLVED OXYGEN AND BIOCHEMICAL OXYGEN DEMAND IN SEWAGE EFFLUENT RELEASES,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 4B.
W81-00088

THE EFFECTS ON GROUNDWATER FROM SEEPAGE OF LIVESTOCK MANURE LAGOONS,
Clemson Univ., SC. Dept. of Agricultural Engineering.
R. O. Hegg, T. G. King, and T. V. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115180, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute, Clemson University Technical Report No 78, September 1979. 47 p, 19 Fig, 3 Tab, 11 Ref, 1 Append. OWRT-B-091-SC(1).

Descriptors: *Groundwater, *Surface-groundwater relationships, *Water pollution, *Livestock, *Farm lagoons, Lagoons, Water quality, Subsurface waters, Dug wells, Groundwater availability, Groundwater resources, Hydrology, Soil water, Underground streams, Water wells, Farm wastes, Test wells, Shallow wells, Water pollution effects.

Three anaerobic swine lagoons in the Southern Coastal Plain of South Carolina were monitored for two years to determine the effects of lagoon seepage on the groundwater. A series of shallow monitoring wells were installed at each lagoon, mostly on the down-gradient side of the lagoon, in a grid pattern. Analyses on well water samples covered temperature, pH, nitrate nitrogen, specific conductance, coliform bacteria, chloride, COD, total organic carbon, ammonia nitrogen, and total kjeldahl nitrogen. Well water table depth, and water consumption were also measured. Most wells showed no discernable trends of changing water quality, but wide variations in the water quality parameters measured were noted. Since most wells were unaffected, non-heterogeneous soil conditions appeared to exist. Subsurface lagoon seepage was impossible to quantitate since only a small number of wells were used, but a water budget compiled for one lagoon indicated an average lagoon leakage rate of 665 liters/day. Lagoon leakage was detected for wells 6 feet from the lagoon, but no groundwater pollution was noted in wells 46 feet away. Use of a larger number of wells was recommended to improve assessment accuracy for subsurface conditions due to soil inhomogeneity. (Zielinski-IPA)
W81-00091

THE INFLUENCE OF URBANIZATION ON THE AQUEOUS TRANSPORT AND DISTRIBUTION OF HEAVY METALS IN THE SADDLE RIVER,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
W. G. Wilber.
Ph.D. Dissertation, May, 1978, 356 p, 59 Fig, 66 Tab, 107 Ref, 3 Append. OWRT-A-050-NJ(2), 14-34-0001-8032.

Descriptors: *Heavy metals, *Water pollution sources, *Sediment distribution, *Path of pollutants, *New Jersey, *Saddle River(NJ), Chemical wastes, Sediment yield, Precipitation, Lead, Copper, Zinc, Stormwater, Urban runoff, Street sweeping.

A study of heavy metals was conducted on a highly developed stretch of the Saddle River near Lodi, New Jersey. The major contributors of heavy metals in stormwater runoff were lead, zinc, and copper. An average of 66 percent of the total suspended solids for three storms studied could be removed after four hours of settling. Unlike the other metals, copper was found predominantly in the soluble plus colloidal fraction of runoff. Relative concentrations of metals in precipitation as compared to those of stormwater were relatively insignificant. Street sweeping samples were also analyzed. Statistical analyses were made relating metals occurrence in water to various related parameters. Concentrations of heavy metals in sediments were variable, but increased passing through the highly developed areas. (Whipple-NJ)
W81-00099

MODIFIED FICKIAN MODEL FOR PREDICTING DISPERSION,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
H. Liu, and A. H. D. Cheng.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY6, Proceedings Paper 15454, p 1021-1040, June 1980. 8 Fig, 3 Tab, 29 Ref, 2 Append. OWRT-A-103-MO(3).

Descriptors: *Dispersion, *Pollutants, *Path of pollutants, *Model studies, Mathematical models, Water pollution, Rivers, Streams, Flow, Forecasting, Oil spills, Chemicals, Accidents.

The ordinary Fickian model for longitudinal dispersion was modified by using a time or distance dependent dispersion coefficient with a time-scale much greater than the Fischer time scale. From the three bulk flow properties, shear velocity, cross-sectional area, and mean depth of stream, the asymptotic dispersion coefficient, longitudinal dispersion coefficient, and the peak concentration maximum or peak concentration in natural streams can be predicted within a factor of 2.5 and 1.6, respectively. The model is useful for the prediction of longitudinal spread of pollutants in rivers over both short and long distances. (Sims-ISWS)
W81-00104

DIURON LOSS FROM A SMALL WATERSHED IN THE HIGH WINTER RAINFALL ZONE OF WESTERN OREGON,
Oregon State Univ., Corvallis. Dept. of Soil Science.
J. Hickman, M. Montgomery, and M. Harward.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113334, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report, September 15, 1980. 10 p, 3 Tab, 4 Ref. OWRT-A-048-ORE(1).

Descriptors: *Herbicides, *Agricultural runoff, Rainfall-runoff relationships, *Small watersheds, Storm runoff, *Mathematical studies, Pesticides, Runoff, Watersheds, Farms, Agricultural watersheds, Agriculture, Crops, Rainfall, Stormflow, Average runoff, Cloudbursts, Direct runoff, Statistical methods, Graphical analysis, Analytical techniques, Gas chromatography, Metabolism, *Path of pollutants.

The herbicide, 3-(3,4-dichlorophenyl)-1)-1,1-dimethyl urea (diuron), was determined in selective runoff samples during storm hydrographs on a 5.1 ha watershed (slopes 3-12%). The watershed was located in southern Polk County about 3 miles south of Monmouth, Oregon. Pre-emergence application of diuron was made at 1.8 kg (active ingredient) per ha to fall-planted winter wheat in late October 1978, about two weeks after planting. Surface runoff from the watershed was measured in a flume, and integrated suspended sediment samples were taken. Following solvent separation of the herbicidally-inactive diuron metabolite, 3,4-dichloroaniline, from the diuron residue, the latter was hydrolyzed to 3,4-dichloroaniline, and its benzene extract analyzed by gas-liquid chromatography with microcoulometric detection. The assay method was sensitive to less than one microgram in a total sample extract. Total diuron loss in the five-month period following application was 0.016 kg/ha, or 0.9% of the total diuron applied. Two major runoffs in early February accounted for 45% of total herbicide loss. A power curve comparing suspended sediment analysis (ppm) against diuron concentration (ppb) was used to calculate total diuron loss from each storm event. The peak herbicide concentration was 80 ppb during the first runoff event, 45 days after application. (Zielinski-IPA)
W81-00109

DEGRADATION OF SELECTED HERBICIDES BY AQUATIC MICROORGANISMS,
Clemson Univ., SC. Dept. of Microbiology.
P. A. Ellis, N. D. Camper, and J. M. Shively.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113326, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Clemson University. Technical Report 84, February, 1980. 36 p, 11 Fig, 11 Tab, 49 Ref, 2 Append. OWRT-A-041-SC(1), 14-34-0001-9043, 14-34-0001-8043, 14-34-0001-7086.

Descriptors: *Herbicides, *2,6-Dichlobenil, *Metabolism, *Aquatic bacteria, *Biodegradation, *Aquatic fungi, *Pollutant identification, Microorganisms, Aquatic microorganisms, Microbial degradation, Fungi, Ponds, Microbiology, Chromatography, Pollutants, Water pollution, Water pollution sources, Pesticide residues, Analysis, Chemical analysis, Assay, Testing procedures.

Degradation of 3-(3,4-dichlorophenyl)-1,1-dimethylurea (diuron) herbicide by pond water and pond sediment microorganisms was studied to assess the degradative pathway. An enrichment procedure was used to isolate microorganisms capable of degrading diuron and, while no such isolate could degrade diuron in pure culture, several mixed fungal/bacterial and mixed bacterial isolated cultures could either partially/totally degrade this herbicide. Studies using radiolabeled diuron (C-14 carbonyl group), mixed culture degradation, and analysis by thin-layer chromatography (TLC), showed that 24-28 day incubation with a mixed fungal/bacterial culture and mixed bacterial cultures gave 78-98% degradation (7 products) and 67-99% degradation (6 products), respectively. The mixed fungal/bacterial culture liberated carbon dioxide as 74-96% of the carbonyl label. TLC analysis indicated the major product formed by most cultures was 3,4-dichloroaniline. Detection of the demethylated derivatives, 3-(3,4-dichlorophenyl)-1-methyl urea and 3-(3,4-dichlorophenyl) urea, suggested a stepwise demethylation of diuron occurred. Similar studies with 2,6-dichlorobenzonitrile (dichlobenil) herbicide showed degradation products of 2,6-dichlorobenzoic acid and 2,6-dichlorobenzamide. (Zielinski-IPA)
W81-00110

SOURCES AND BEHAVIOR OF NATURAL RADIOACTIVITY IN FALL LINE AQUIFERS NEAR LEESVILLE, SOUTH CAROLINA,
South Carolina Univ., Columbia.
For primary bibliographic entry see Field 5A.
W81-00113

MODELING OF HEATED SURFACE JETS,
State Univ. of New York at Buffalo. Dept. of Mechanical Engineering.
R. Chang, L. Liu, C. Santanam, and L. A. Kennedy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-116857, Price codes: A09 in paper copy, A01 in microfiche. Final Technical Report prepared for Office of Water Research and Technology, September 1979, 179 p, 70 Fig, 2 Tab, 48 Ref, 2 Append. OWRT C-6038(No 5203)(1), 14-31-0001-5203.

Descriptors: *Thermal pollution, *Flow, *Stratified flow, *Thermal water, *Measurement, Computer models, Mathematical models, Jets, Surfaces, Turbulence, Temperature, Velocity, Reynolds number, Diffusion, Heat flow, Research equipment.

Laboratory studies of heated water jets were undertaken to model real-life discharges by thermal power plants. Thermal pollution can be controlled if there can be an accurate prediction of the water temperature and velocity distribution in the disposal area. A Laser-Doppler Velocimeter (LDV) system was developed to measure the velocity of the heated jets without the use of dyes or floating objects. The thermally stratified surface jets were analyzed at a particular Richardson Number and Reynolds Number. The turbulent entrainment of temperature stratified flows was also measured and the range of Reynolds numbers was quite narrow and the mixing coefficients were found to only be functions of the local Richardson number. Dye injection studies gave the centerline trajectories and plume widths by varying the four dimensionless parameters: Richardson number, velocity ratio, channel width, and jet aspect ratio. A numerical model was developed for predicting the behavior of a heated surface jet as it penetrates a quiescent body of water. The model uses the two equation K-epsilon turbulence model including bouyancy effects. Stability problems in the turbulence portion of the calculations gave anomalies such as overpredicted centerline temperatures far from the discharge point and under-prediction for the lateral spread of the jets for small values of the initial Richardson number. (Sidney-IPA)
W81-00114

PROCESS FOR CONCENTRATING TRITIUM AND/OR TRITIUM HYDRIDE AND SEPARATING IT FROM TRITIUM WATER,
Hoechst A.G., Frankfurt am Main (Germany, F.R.).
For primary bibliographic entry see Field 5D.
W81-00126

HYDROGEOLOGIC DATA FOR THE MCKAY CREEK SUBSURFACE WASTE-INJECTION TEST SITE, PINELLAS COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 3C.
W81-00152

HYDROLOGY OF THE CHICOD CREEK BASIN, NORTH CAROLINA, PRIOR TO CHANNEL IMPROVEMENTS,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 4A.
W81-00154

THE BALTIC SYSTEMS OF MAN AND NATURE. A PERSPECTIVE FOR THIS ISSUE,
B.-O. Jansson.
Ambio, Vol 9, No 3-4, p 112-113, 1980. 1 Fig, 2 Ref.

Descriptors: *Water pollution, *Natural resources, *Water resources, *Environmental effects, *Oceans, Mine wastes, Municipal wastes, Industrial wastes, Water circulation, Marine fish, Sands, Fossil fuels, Urbanization, Planning, Waste water, Sea water, Baltic Sea, Water pollution control.

This introduction to a series of articles on the Baltic stresses the interrelationships between natural and man-made systems in this area. Natural

systems, including climate, inflowing water from rivers and from the North Sea, fish, and mineral products, are impacted by human exploitation and by the production of wastes, both water- and airborne. Wastes are the products of urban and industrial systems, such as the food industry and the exploitation of minerals. The use of fossil fuel has resulted in the introduction of nutrients but also of hazardous substances into the waste water flow. In the Baltic area, both governmental and non-governmental organizations are concerned with the scientific use of the Sea. Several conventions for protecting the Baltic from pollution have been agreed upon by its seven bordering states. (Gish-FRC)
W81-00202

POLLUTION FROM INDUSTRIES IN THE DRAINAGE AREA OF THE BALTIC,
Swedish Water and Air Pollution Research Lab., Stockholm.
L. Bruneau.
Ambio, Vol 9, No 3-4, p 145-152, 1980. 8 Fig, 8 Tab, 14 Ref.

Descriptors: *Industrial wastes, *Agricultural runoff, *Pulp wastes, *Pollutants, *Water pollution control, Baltic Sea, Oceans, Water pollution, Rivers, Lignins, Nitrogen, Phosphorus, Organic wastes, Copper, Fertilizers.

Pollution in the Baltic Sea by industrial activities in surrounding countries is reviewed. Possible ways in which the ever-increasing level of pollution can be monitored and eventually reduced are considered. The largest consumer of water among the industries in this region is the pulp and paper industry. Scandinavian countries have reduced the pollution from this industry, but there are still severe problems. Specific industrial problems are discussed for the Bothnian Bay area, the Bothnian Sea, the Gulf of Finland, the Gulf of Riga, and the Baltic itself. Estimated discharge figures in kilotonnes/yr are 0.006 (via rivers) for copper, 4.8 (57.4 via rivers) for nitrogen, 1.4 (0.76 via rivers) for phosphorus, 571.6 for lignin and 343.5 (201.5 via rivers) for BOD7. Estimates for chlorinated phenolic compounds are also given. Primary means of reducing pollution in this area of concern are noted. The most dramatic improvements in BOD and lignin discharge came about in the middle 1940s with the development of a process for evaporation and burning of sulfite liquors. Most of the improvements have been made in Sweden, with the other countries lagging behind. (Baker-FRC)
W81-00203

DEPOSITION OF AIRBORNE POLLUTANTS ON THE BALTIC,
Stockholm Univ. (Sweden). Meteorologiska Institutionen.
H. Rodhe, R. Soderlund, and J. Ekstedt.
Ambio, Vol 9, No 3-4, p 168-173, 1980. 2 Fig, 8 Tab, 37 Ref.

Descriptors: *Precipitation, *Air-water interfaces, *Pollutants, *Water pollution sources, *Air pollution effects, Baltic Sea, Organic compounds, Nitrogen compounds, Lead, DDT, Polychlorinated biphenyls, Air pollution, Oceans.

The pollution of the Baltic Sea by airborne pollutants is considered with emphasis on the deposition process. Downward transport across the air-sea interface may be divided into wet deposition (fallout in precipitation) and dry deposition (gravitational setting, transport by turbulent eddies, molecular diffusion, and impaction by inertia). Deposition rates for a number of pollutants are given, suggesting that atmospheric deposition is a major source of nitrogen compounds (120,000-1.3 million tons/yr) and lead (600-5,000 tons/yr) in the contaminated Baltic Sea area. A meteorological study of the area indicates that the turnover time for water in the Baltic Sea is about 15 yr. Surface waters have a normally shorter residence time. Concentration data is provided for inorganic nonmetals, metals, radionuclides, and organic compounds in the Baltic Sea. The deposition of DDT and polychlorinated biphenyls in various areas of Sweden varies from 960 to 2,120 and 1,400 to 1,780 ng/sq m/month, respectively. Estimates of the annual flux of a number of pollutants from the atmosphere to the Baltic Sea have been calculated from the methods and data presented. (Baker-FRC)
W81-00204

MEDITERRANEAN STATES AGREE ON TREATY TO CONTROL LAND-BASED POLLUTION,
For primary bibliographic entry see Field 6E.
W81-00213

EFFECT OF SALINITY ON METHYLATION OF MERCURY,
Cook Coll., New Brunswick, NJ. Dept. of Biochemistry and Microbiology.
J. E. Blum, and R. Bartha.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 404-408, September, 1980. 1 Fig, 17 Ref.

Descriptors: *Salinity, *Mercury, *Estuarine environment, *Marine microorganisms, Inorganic compounds, Sediments, Anaerobic conditions, Incubation, Laboratory tests, Analytical techniques, Freshwater, Saline water.

The effects of salinity on microbial methylation of inorganic and phenylmercury compounds to mono- and dimethylmercury were evaluated utilizing sediments from an estuarine environment. Sediment samples collected from the Cheesequake Creek in New Jersey were slurried with water from a freshwater pond in a sediment to water ratio of 2:1 and then mixed with sea salts to achieve the desired salinity. To the slurry was added 10 ppm mercury as HgCl2; some samples were mixed with 0.2% NaN3 to suppress microbial methylation. Analysis of the samples indicated that the rate and extent of microbial methylation of mercury ions in anaerobically incubated estuarine sediment samples occurred in an inverse relationship to salinity, with methylation performed most rapidly at the lowest salinity of 0.1%. Methylmercury concentrations decreased after 15-20 days of incubation, and these decreases were attributed to microbial demethylation. Further studies on mercury methylation in freshwater and salt water were recommended. (Lisk-FRC)
W81-00217

ACCIDENTAL CHEMICAL SPILLS. A REVIEW OF INCIDENTS IN THE OHIO RIVER VALLEY, 1978 AND 1979,
R. C. Kroner.
Public Works, Vol 111, No 10, p 48-50, October, 1980. 1 Fig, 5 Tab.

Descriptors: *Ohio River, *Chemical wastes, *Accidents, *Water law, Law enforcement, Water pollution, Industrial wastes, Rivers, Organic wastes, Inorganic compounds, Oil pollution, Oil wastes, Sewage, Legislation, Water pollution control.

Information from reports on chemical spills filed with the Ohio River Valley Water Sanitation Commission according to federal law is presented in an attempt to acquaint the public with the spectrum of industrial materials which are escaping into the waterways of the Ohio River Valley. While it is acknowledged that merely cataloguing such incidents will not abate their occurrence, a periodic review of these happenings will indicate additional precautions and legislation that will aid in reducing their occurrence in the future. In 1978, a total of 150 spills was reported. In 1979, 161 such spills were reported. In the 2-yr period, there were more than 100 petroleum product spills, usually in the range of < 100 to 1,000 gallons, though one loss in 1979 was of 45,000 gallons. Other spills in 1979 included raw sewage (30 million gallons), industrial waste mixtures (phenol, cyanide, oil, and greases, 36 million gallons; chlordane-hexachloropentadiene, 0.5 million gallons), formic acid - hydrochloric acid (0.19 million gallons), and carbon black (800 barrels). Miscellaneous wastes spilled into the Ohio in 1979 included steel mill sludge, pickle rinse, lime slurry, glass furnace sludge, and paint sludge. Multi-component spills are a common occurrence. Most spills occur in the most heavily industrialized areas, along the north bank of the Ohio along the Ohio state boundary. From Cincinnati to its confluence with the Mississippi, the river is almost spill-free. The number of spills reported by states in 1978 and 1979 ranged from 157 in Ohio to 2 in Illinois. Some reports received by lay people are based purely on visual observations. (Baker-FRC)
W81-00222

EVIDENCE FOR THE DECOUPLING OF DISSOLVED, PARTICULATE AND SURFACE MICROLAYER HYDROCARBONS IN NORTHWESTERN ATLANTIC CONTINENTAL SHELF WATERS,
Energy Resources Co., Inc., Cambridge, MA. Aquatic Sciences Div.
P. D. Boehm.
Marine Chemistry, Vol 9, No 4, p 255-281, August 1980. 7 Fig, 6 Tab, 38 Ref.

Descriptors: *Organic compounds, *Oil pollution, *Continental shelf, *Films, *Sea water, Water sampling, Dissolved solids, Pollutant identification, Gas chromatography, Water analysis, Chemical analysis, Oily water, Sampling.

Various stations set along the Georges Bank area off the New England coast were sampled to determine the seasonal, spatial and depth variations in dissolved, particulate and surface microlayer water. Large spatial and temporal heterogeneity was discovered in the origin of hydrocarbons upon analysis of water column samples by high-resolution gas chromatography. Surface film hydrocarbons were present at higher levels than dissolved fractions. Dissolved fractions were more abundant than particulate hydrocarbons in the water column. Surface film and dissolved hydrocarbons showed slight differences although both were mainly of a petroleum source. Bulk-water particulate was of a mixed biogenic and petrogenic origin. Due to the differences in hydrocarbons found in the surface microlayer and the bulk water, a microlayer enrichment factor was not considered. Hydrocarbons of the surface film, bulk water particulate matter and dissolved hydrocarbons were all decoupled with regard to origin and concentration in the area studied. (Geiger-FRC)
W81-00244

THE BIOGEOCHEMISTRY OF SEDIMENTS IN TWO GULF OF MAINE BASINS,
New Hampshire Univ., Durham. Dept. of Earth Sciences.
W. B. Lyons, M. E. Hines, G. M. Smith, and A. D. Hewitt.
Marine Chemistry, Vol 9, No 4, p 307-320, 1980. 1 Fig, 7 Tab, 60 Ref.

Descriptors: *Biochemistry, *Gulfs, *Maine, *Geochemistry, *Sediments, Analytical techniques, Nitrification, Marine bacteria, Carbon, Sedimentation rates, Sulfates, Denitrification, Water sampling, Sea water.

A preliminary study was made of deeper water continental shelf sediments off the Gulf of Maine Basins. Sediment from Jeffreys Basin exhibited low organic carbon content and low reduced sulfur values. The pore water values indicated that nitrification with subsequent denitrification were the major biogeochemical processes which were occurring in the upper 115 cm of the water. Wilkinson Basin sediments demonstrated higher organic carbon values and higher reduced sulfur and total plate-count bacteria. Thus the major biogeochemical processes occurring in these latter sediments were denitrification with sulfate reduction. The difference in sedimentation rates at the two basins is shown to influence the differences in the rates of the microbially mediated processes found in each basin. (Baker-FRC)
W81-00245

LAND-BASED INPUTS OF SOME MAJOR POLLUTANTS TO THE BALTIC SEA,
International Council for Exploration of the Sea.

Copenhagen (Denmark).
J. Pawlak.
Ambio, Vol 9, No 3-4, p 163-167, 1980. 3 Fig, 4 Tab, 11 Ref.

Descriptors: *Pollutants, *Organic wastes, *Domestic wastes, *Nitrogen, *Phosphorus, Industrial wastes, Water pollution sources, Baltic Sea, Sewage, Rivers, Heavy metals, Polychlorinated biphenyls, Pesticides, Oceans, Agricultural runoff, Nutrients, Pollutant identification.

Some of the major sources of pollutants to the Baltic Sea are discussed. Organized study of the input of pollutants to the Baltic Sea began about 1970 when the International Council for the Exploration of the Sea compiled estimates of domestic sewage and industrial discharge inputs. Currently, the fate of pollutants in the Baltic Sea and their exchange with other pollutants in the North Sea are being studied. Of all the pollutants present, the most reliable estimates for concentration are made of the organic matter and nutrients nitrogen and phosphorus. Sources of organic matter include untreated domestic sewage, effluents from food processing and paper and pulp industries, and humic substances in runoff water from agricultural sites. About half of the organic matter in the Baltic is transported there by the river systems. The annual input of phosphorus to the Baltic Sea is 25,825 tons, while that of nitrogen is 308,890 tons, and that of organic matter (estimated as BOD7) is 1,354,700 tons. Among industrial wastes in the Sea are heavy metals such as mercury, cadmium, lead, chromium, copper, zinc, nickel and iron. Organohalogen compounds such as polychlorinated biphenyls and certain pesticides are also present, along with petroleum hydrocarbons. (Baker-FRC)
W81-00247

5C. Effects Of Pollution

TESTS OF TWO FLUOROMETRIC ASSAYS FOR GONYAULAX AND APHANIZOMENON TOXINS,
New Hampshire Univ., Durham. Dept. of Biochemistry.
For primary bibliographic entry see Field 5A.
W81-00020

EFFECTS OF A HEPATIC TOXIN FROM THE CYANOPHYTE, MICROCYSTIS AERUGINOSA,
New Hampshire Univ., Durham. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W81-00026

THE EFFECT OF CHEMICAL SPECIATION ON THE EQUILIBRIUM, WHOLE-BODY CADMIUM CONTENT OF LARVAE OF THE CADDISFLY, HYDROPSYCHE SP.
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
S. A. Dressing.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-111304, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis, 1980. 88 p, 9 Fig, 19 Tab. OWRT-A-095-NC (2), 14-34-0001-9035.

Descriptors: *Cadmium, Heavy metals, *Aquatic organisms, Cadmium in water, Cadmium in organisms, *Caddisflies, Aquatic insects, Reproduction, Larvae, Toxicity, Testing procedures.

The correlations between heavy metal concentrations in caddisfly larvae and both total cadmium and free cadmium ion concentrations were studied in the laboratory to determine the effect of chemical speciation on the equilibrium cadmium burden of the caddisfly larvae. Nitrilotriacetic acid (NTA) was added to inorganic test media to serve as a chelator. Cadmium in water and test organisms was determined by both graphite furnace atomic absorption spectrophotometry (GFAAS) and conventional flame atomic absorption spectrophotometry (FAAS). Cadmium speciation was calculated by the REDEQL2 chemical equilibrium computer program. Organism cadmium concentration was found to be a function of the total cadmium concentration in the media, not the free cadmium ion concentration. The biological variation inherent in the test organisms was found to be the largest factor limiting the experimental reproducibility, but replicate test systems produced very similar results.
W81-00030

EFFECT OF AGRICULTURAL LAND DEVELOPMENT ON DRAINAGE WATERS IN THE NORTH CAROLINA TIDEWATER REGION,
North Carolina State Univ. at Raleigh. School of Agriculture and Life Sciences.
R. W. Skaggs, J. W. Gilliam, T. J. Sheets, and J. S. Barnes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-105959, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute of The University of North Carolina, Raliegh, Report No 159, 1980. 110 p, 49 Fig, 48 Tab. OWRT-B-102-NC (1), 14-34-0001-7174.

Descriptors: *Drainage effects, *Water quality, Water quantity, Agricultural drainage, *Agricultural runoff, Nutrients, Phosphorus, Nitrogen, Pesticides, Soil properties, Rainfall, Water analysis, Soil analysis, Chemical analysis, Tidewater Region(NC).

A three year study was conducted to determine the effects of agricultural drainage and development on hydrology and runoff water quality on high organic soils in the North Carolina Tidewater Region. Experiments were conducted on paired developed and undeveloped sites of three different soils that span the range of soils being developed in the Tidewater Region. Each of the six sites (three developed, three undeveloped) were instrumented to continuously measure the rate of runoff, to sample for water quality and pesticide analyses, and to determine other variables such as rainfall and water table depth. Peak runoff rates occur earlier and are three to four times higher on developed than on similiar undeveloped lands. There is a small but significant increase in inorganic nitrogen in drainage water as a result of agricultural development of these organic rich soils. However, the true organic soils which are developed lose considerably more phosphorus to drainage waters. Development of the mineral soil has a very small effect on phosphorus losses. One potential water quality problem is the movement of fecal organisms from grazed pastures into drainage water.
W81-00037

THERMAL EFFECTS ON PRIMARY PRODUCTIVITY OF PHYTOPLANKTON, PERIPHYTON AND MACROPHYTES IN LAKE KEOWEE, SOUTH CAROLINA,
Clemson Univ., SC. Water Resources Research Inst.
C. R. Dillon, and J. H. Rodgers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112435, Price codes: A06 in paper copy, A01 in microfiche. Report No 81, 1980, 115 p, 8 Fig, 8 Tab, Append. OWRT B-053-SC (1).

Descriptors: *Primary productivity, Thermal loading, *Phytoplankton, *Periphyton, Macrophytes, *Thermal pollution, Lakes, *Nuclear powerplants, Environmental effects, Nutrients, Water quality, Aquatic plants, Growth rates, South Carolina, *Lake Keowee(SC).

Productivity of phytoplankton, periphyton and macrophytes at three stations in Lake Keowee was measured from April, 1973 to April, 1975. Average monthly productivity for phytoplankton was 1097.19, 1037.33 and 880.54 mg C m super -2 m0 super -1 at Stations 1, 2, and 3 respectively. Monthly averages of periphyton productivity were 158.63, 108.87 and 211.39 mg C m super -2 mo super -1 for Stations 1, 2 and 3 respectively. Macrophytes occurred only at Station 3. For the fourteen months they were present, macrophytes averaged 660.4 mg C m super -2 mo super -1. Ludwigia palustris (L.) E., and Potamogeton diversifolius Raf., previously unreported from Oconee County, were the only submerged aquatic macrophytes found. From the thermal profiles there tended to be an autumnal turnover. Based on the temperature data, Lake Keowee would be classified as a warm, monomutic lake. Both low nutrient concentrations and low productivity classifies Lake Keowee as an oligitrophic lake. This investigation could demonstrate no significant effect of thermally elevated reactor cooling effluents on the productivity of phytoplankton or periphyton. The occurrence of macrophytes only in the thermally affected area is considered to be an artifact of substrate coupled with the possibility that some additional effect may be realized from water currents generated by pumping action
W81-00038

EFFECTS OF ATRAZINE ON CHESAPEAKE BAY AQUATIC PLANTS,
Auburn Univ., AL. Dept. of Botany, Plant Pathology, and Microbiology.
D. R. Forney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115560, Price codes: A05 in paper copy, A01 in microfiche. Master of Science Thesis, August 26, 1980. 86 p, 1 Fig, 13 Tab, 83 Ref. OWRT-A-067-ALA(1)

Descriptors: *Triazine pesticides, *Water pollution effects, *Water pollution sources, *Aquatic plants, *Chesapeake Bay, Pesticides, Chlorinated hydrocarbons, Agricultural runoff, Toxicity, Toxins, Environmental effects, Plant pathology, Halogenated pesticides, Alabama, Water pollution, Plant growth, Growth chambers.

The possibility of atrazine runoff from farmland being involved in the observed decline in submerged plant populations in Chesapeake Bay in recent years, was investigated using growth chamber studies. Dose-reponse studies using elodea and redheadgrass plants grown in jars in nutrient solution containing varying atrazine concentrations showed the 1% growth inhibition concentration level to be a few parts per billion (ppb) atrazine. A somewhat higher atrazine concentration gave a 1% inhibition of Eurasian watermilfoil growth. Atrazine concentrations calculated for 50% growth inhibition were 13 ppb for elodea, 163 ppb for wildcelery, 474 ppb for redheadgrass, and 1104 ppb for Eurasian watermilfoil. While growth of the brackish species wildcelery was inhibited both by salinity and by atrazine, no significant inhibition interaction was observed for these variables. When low atrazine levels were present in both the water and the soil, the water concentration determined the toxic event. Soil concentrations of atrazine less than 1000 ppb had no effect. The study concludes that, from the atrazine concentrations detected in Chesapeake Bay samples, atrazine was not likely to have caused the observed decline of submerged plants in the Bay. (Zielinski-IPA)
W81-00046

LIMNOLOGY OF LAGO LOIZA, PUERTO RICO,
Geological Survey, San Juan, PR. Water Resources Div.
F. Quinones-Marquez.
Geological Survey Water-Resources Investigations 79-97, February 1980. 113 p, 44 Fig, 26 Tab, 48 Ref.

Descriptors: *Limnology, *Water quality, *Lakes, *Puerto Rico, *Eutrophication, Chemical properties, Physical properties, Biological properties, Sediments, Reservoirs, Storage capacity, Hydrologic budget, Bacteria, Dissolved oxygen, Water temperature, Nutrients, Plankton, Hydrologic data, *Lago Loiza(PR).

The principal chemical, physical and biological characteristics of Lago Loize, P.R., and its main tributaries were studied from 1973-74. The lake supplies an average of 300,000 cubic meters per day of water to metropolitan San Juan. Flows from Rio Grande de Loize and Rio Gurabo contribute 84.0 percent of the water, 67.3 percent of the nitrogen, and 66.8 percent of the phosphorus to the lake. About 31 percent of the nitrogen and 45

percent of the phosphorus were retained in the lake, which has a mean flusing rate of 19 times per year. The lake's capacity declines at a rate of about 1.9 percent per year and is about 14.9 million cubic meters. Sewage inputs to the lake's tributaries average 18,560 cubic meters per day. Fecal coliform bacteria in numbers ranging from 100 to 6,700,000 were recorded throughout the tributaries and the lake. In the lake, dissolved oxygen concentration is less than 5.0 milligrams per liter below the 1.5-meter depth. Lago Loize is a hypereutrophic lake, with an average total nitrogen concentration of 1.7 milligrams per liter and 0.33 milligram per liter of total phosphorus. (USGS)
W81-00067

EFFECT OF FLUCTUATING RESERVOIR RELEASE ON THE DOWNSTREAM ENVIRONMENT,
Michigan Technological Univ., Houghton. Dept. of Biological Sciences.
For primary bibliographic entry see Field 4A.
W81-00087

THERMAL STRESS STUDIES ON SELECTED ZOOPLANKTON SPECIES AND AN ISOPOD,
Tennessee Univ., Knoxville. Dept. of Zoology.
D. L. Bunting, and N. J. Cheper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115610, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center. University of Tennessee Report No 76, June 1980. 50 p, 6 Fig, 7 Tab, 76 Ref. OWRT-A-049-TENN(1), 14-34-0001-0145.

Descriptors: *Zooplankton, *Thermal pollution, *Water temperature, *Cooling water, *Industrial water, Industries, Industrial wastes, Recirculated water, Industrial plants, Aquatic microorganisms, Aquatic life, Water utilization, Water resources, Water supply, Heat pollution, Heated water, Water pollution sources.

Laboratory determination of temperature stress levels and assessment of their ecological consequences was carried out for selected zooplankton species to develop data for ecological impact associated with industrial use of natural water for cooling. An included literature search revealed substantial fish and benthos data, but little on stress temperature effects on zooplankton. Information was gathered on two cladocerans (Daphnia pulex and Simocephalus exspinosus), four copepods (Mesocyclops edax, Diaptomus reighardi, D. stagnalis, and D. clavipes), and an isopod (Lirceus brachyurus). The time lapse until 95% mortality was determined for D. pulex immatures acclimated at 15 and 25 degrees C, and the lethal temperature causing 50% mortality was determined for adult and immature S. exspinosus acclimated at 15 degrees C and tested at 20, 25, and 30 degrees c. A general trend was observed for the time to mortality to increase with acclimation temperature increase; and for a given acclimation temperature, for mortality time to decrease with increasing test temperatures (25-35 degrees C). Time estimates to 50% mortality for the copepods suggested that intersex tolerance differed at specific temperatures, but, overall, increasing test temperatures decreased survival time. Isopod survival increased with increasing acclimation temperature. Suggested future research included modeling of the effects noted, based on a detailed field study of secondary production. (Zielinski-IPA)
W81-00090

EFFECTS OF AGRICULTURAL DRAINAGE DEVELOPMENT ON BENTHIC INVERTEBRATES IN UNDISTURBED DOWNSTREAM REACHES,
Minnesota Univ., St. Paul.
P. C. Marsh, and T. F. Waters.
Transactions of the American Fisheries Society, Vol 109, No 2, p 213-223, March 1980. 2 Fig, 5 Tab, 25 Ref. OWRT-B-120-MINN(2), 14-31-0001-6091.

Descriptors: *Channel improvement, *Agricultural runoff, *Effects, *Invertebrates, Insects, Benthic fauna, Sediments, Suspended solids, Turbidity, Streams, Runoff, Water chemistry, Water temperature, Dissolved oxygen, Hydrogen ion concentration, Carbon dioxide, Discharge(Water), Streamflow, Sampling, Surveys.

The downstream effects of channelization and agricultural drainage development were evaluated in southwestern Minnesota by comparing benthic invertebrate populations in streams heavily modified by channelization and agricultural drainage development in upstream areas with those not so modified. Physicochemical characteristics, as well as invertebrate populations, were observed in relatively undisturbed downstream reaches. Turbidity, total alkalinity, and timing of discharge were similar in all streams. Species compositions of benthic invertebrates were similar in all streams, and there were no significant differences in total, seasonal, or monthly levels of standing stock in either numbers or biomass between modified and unmodified streams. Invertebrate drift, both insects and total invertebrates, was similar in all streams. Some differences in individual taxa were observed, but these were related to localized differences between streams rather than to drainage development. Specific differences included higher numbers in drift of the snail Physa gyrina and the amphipod Hyalella azteca in one modified stream, apparently the result of more suitable upstream habitat in drainage ditches. It was concluded that, in these agricultural areas, the impact of upstream drainage development on benthic invertebrates in natural downstream reaches was negligible. (Sims-ISWS)
W81-00103

SOURCES AND EFFECTS OF COLOR IN THE WISCONSIN RIVER, WISCONSIN,
Wisconsin Univ.-Stevens Point. Coll. of Natural Resources.
C. Mechenich, B. H. Shaw, and T. S. Roeder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113342, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin, Madison, Technical Report WIS-WRC 80-09, 1980. 52 p, 6 Fig, 9 Tab, 47 Ref, 3 Append. OWRT-A-080-WIS, 14-34-0001-8053, 14-34-0001-9053.

Descriptors: Color, Light, Water quality, Wisconsin, Waste water disposal, Federal Water Pollution Control Act, Light penetration, Algae, *Pulp and paper industry, *Waste water(Pollution), *Color reactions, *Environmental effects, *Wisconsin River.

The Wisconsin River has been extensively used for power production and industrial and municipal wastewater disposal. Man's past uses of the river caused serious water quality problems. However, water quality in the Wisconsin River has substantially improved since the implementation of the wastewater treatments requirements of the 1972 amendments to the Federal Water Pollution Control Act (PL 92-500). Presently, wastewater discharges from the pulp and paper industry, especially during periods of low flow, influence the color of the Wisconsin River. The effect of color and associated effects of light penetration on the growth of algae in Lake Du Bay were investigated. Carbon assimilation rates increased as water color decreased, except for occasional instances of surface inhibition. Changes in carbon (C) assimilation rates varied with depth. Multiple regression analysis indicated that red light penetration was the most significant predictor of C assimilation rate changes. The contribution of industry to true and apparent color of the Wisconsin River appears to lower algal productivity in reservoirs. Further restrictions of industrial discharges without simultaneous reductions in nutrient pollution could cause more severe algal bloom problems than presently exist. Such relationships must be considered seriously in water quality planning and implementation of the provisions of PL 92-500.
W81-00107

INFLUENCE OF 2,4-D AND 2,4,5-T ON LIFE HISTORY CHARACTERISTICS OF CHIRONOMUS (DIPTERA: CHIRONOMIDAE),
Clemson Univ., SC. Dept. of Zoology.
C. F. Sigmon.
Bulletin of Environmental Contamination and Toxicology, Vol 21, p 596-599, 1979. 2 Tab, 11 Ref. OWRT-A-038-SC(2).

Descriptors: *Pollutants, *Aquatic life, *Midges, *Diptera, *2,4-D, *2,4,5-T, *Bioassay, *Lethal limit, *Toxicity, Water pollution sources, Water pollution, Water quality, Water pollution effects, Insects, Herbicides, Mortality, Pesticide residues, Toxins, Population, Inhibitors, Safety, Sewerage, Sewage treatment, Sewers, Agricultural runoff.

This study was designed to examine the effect of the butoxyethanol esters of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) on pupation, emergence, and mortality in Chironomus sp. Combinations of the herbicide concentrations and temperatures chosen for study were similar to those observed in nature. Chironomus (midges) were collected from a sewage oxidation pond and sorted into three size classes. Ten animals/class were placed in culture dishes with fresh lake water and acclimated under incubation to 20, 25, or 30 degrees, followed by exposure to 1 or 3 ppm (acid equivalent) of either of the two herbicides. The only responses that appeared notable relative to controls were increased larval mortality, and decreased pupation and emergence at 30 degrees for 2,4-D. Although midges adequately withstood the herbicides at lower temperatures, the combined stress of temperature and herbicide was less well tolerated. While lethality studies on aquatic animals related to concerns for agriculture/forest runoff and aquatic weed control involving 2,4-D and 2,4,5-T have been reported, sublethality studies have been scarce. In the present study, control versus treatment differences were not sufficiently great to severely limit organisms such as midges which produce large numbers of eggs. (Zielinski-IPA)
W81-00116

OXYGEN CONSUMPTION IN LEPOMIS MACHROCHIRUS EXPOSED TO 2,4-D OR 2,4,5-T,
Clemson Univ., SC. Dept. of Zoology.
C. Sigmon.
Bulletin of Environmental Contamination and Toxicology, Vol 21, p 826-830, 1979. 2 Tab, 11 Ref. OWRT-A-038-SC(3).

Descriptors: *Herbicides, *2,4-D, *2,4,5-T, *Oxygen demand, *Respiration, *Sunfishes, *Fish behavior, *Water pollution effects, Pesticides, Oxygen requirements, Fish, Fish toxins, Water pollution, Water quality, Environmental effects, Pesticide residues, Mathematical models, Analytical techniques, Gas chromatography, Metabolism, Mathematical studies, Absorption.

Metabolic response was examined soon after exposure to 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) herbicides and short-term uptake by Lepomis macrochirus (bluegill sunfish) was determined. Short time periods were used since herbicides dissipate readily and fish would only be exposed to relatively high concentrations soon after herbicide application. Respiration was measured at 20, 25, and 30 degrees. Herbicide uptake was determined on fish maintained eight days at 20, 25, or 30 degrees in 3 ppm of 2,4-D or 2,4,5-T. A stepwise multiple regression was used to test the importance of herbicides, temperatures, and fish weight in predicting log-transformed respiration. The log transformation allowed comparison with other fish respiration data. Data were consistent with the hypotheses that the response of respiration to weight was independent of temperature. The influence of temperature on respiration was evident from the intercepts with elevated respiration at 30 degrees. More 2,4,5-T than 2,4-D was retained by the fish. Respiration was measured using a closed system and the azide modification of the Winkler technique. Herbicide levels in fish were determined as their methyl esters by analysis of cleaned-up extracts using gas-liquid chromatography with electron capture detection. (Zielinski-IPA)
W81-00117

OXYGEN CONSUMPTION IN DAPHNIA PULEX EXPOSED TO 2,4-D OR 2,4,5-T,
Clemson Univ., SC. Dept. of Zoology.
C. Sigmon.
Bulletin of Environmental Contamination and Toxicology, Vol 21, p 822-825, 1979. 2 Tab, 6 Fig. OWRT-A-038-SC (4).

Descriptors: *Pollutants, *Aquatic life, *Oxygen demand, *2,4-D, *2,4,5-T, *Bioassay, Toxicity, Water pollution sources, Water pollution, Physiological ecology, Water quality, Water pollution effects, Herbicides, Pesticide residues, Agricultural runoff, Toxins, Inhibitors, Safety, Thermal stress, Water temperature, Lakes, Ponds.

The effect of the butoxyethanol esters of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) on oxygen consumption was studied in Daphnia pulex, an important freshwater animal due to its role as a food chain intermediate in temperature-zone lakes/ponds receiving agricultural runoff. Oxygen consumption is a useful measure of sublethal effects since energy processes serve to indicate the overall physiological activity state. Daphnia were laboratory cultured in pond water and acclimated at 20, 25, or 30 degrees with a 12-hour light, 12-hour dark photoperiod. Daphnia were maintained under incubation for one day prior to respiration measurement at 20 degrees, but were maintained under incubation for several days prior to respiration measurement at 25 and 30 degrees. Herbicide exposure (1 or 3 ppm pondwater solutions) was made shortly before oxygen consumption measurement. While both herbicides appeared to increase respiration at 30 degrees, statistical significance was only achieved for 2,4,5-T (at 3 ppm). Variability in the data was observed. The sharp increase noted for treatment with 3 ppm 2,4,5-T at 30 degrees could have been the result of the net effect of herbicide and temperature, analogous to an earlier proposition for sharp increases in the oxygen consumption-temperature curve for physiological systems. (Zielinski-IPA)
W81-00118

MAN'S IMPACT ON THE BALTIC ECOSYSTEM,
Abo Akademi, Turku (Finland). Inst. of Biology.
E. Leppakoski.
Ambio, Vol 9, No 3-4, p 174-181, 1980. 8 Fig, 3 Tab, 50 Ref.

Descriptors: *Ecosystems, *Balance of nature, *Baltic Sea, *Water pollution effects, *Aquatic life, Oceans, Land use, Eutrophication, Oxygen, Plankton, Water pollution control, Mercury, Heavy metals, DDT, Polychlorinated biphenyls, Aquatic animals, Fish, Water birds, Oil pollution, Water pollution sources, Industrial wastes, Chemical wastes.

Man's activities in the area of the Baltic Sea have resulted in excessive eutrophication and damaging oil spills, as well as contamination with industrial wastes such as heavy metals and toxic substances like polychlorinated biphenyls (PCBs). The biomass of the Baltic area is seriously affected. Changes in species composition have occurred, some being in danger of extinction (e.g. osprey, seals) and some having been introduced to the area (e.g. muskrat, Chinese mitten crab, herring gull). Excess eutrophication speeds up the development of anoxic conditions in stagnating bottom water and in the formation of hydrogen sulfide in the semi-isolated deep basins of the southern and central Baltic, causing heavy blooms of planktonic algae and decreased transparency of the water. Periods of oxygen depletion have been becoming longer and more frequent since the 1950s, and bottom areas devoid of macroscopic life increased up to 1972 (69,000 sq km in the Gotland Deep) but decreased slightly in 1973 (56,000 sq km). The most severe pollutant problem in the Baltic appears to be PCBs, with the concentration of PCBs in guillemot eggs rising from $<$ 300 mg/kg in 1968 to $>$ 350 mg/kg in 1975, peaking in 1973 at $>$ 400 mg/kg. During the last 10 yr, the concentrations of mercury in fish from certain coastal areas has decreased to one-third earlier amounts. Concentrations of DDT have also begun to fall since the use of these products has been restricted; however, in 1975, the average content of DDT in guillemot eggs was about 450 mg/kg. It is not possible to assess the full impact of human activities on the Baltic Sea's ecosystem, though it seems unlikely that pollution control and cleanup measures can completely counteract the effects of overexploitation of fish resources, chemical pollution, introduction of new species, and land mismanagement. (Baker-FRC)
W81-00201

THE EFFECT OF INORGANIC AND ORGANIC MERCURY ON GROWTH KINETICS OF NITZSCHIA ACICULARIS W. SM. AND TETRASELMIS SUECICA BUTCH,
Santiago Univ. (Spain). Dept. of Microbiology.
B. Mora, and J. Fabregas.
Canadian Journal of Microbiology, Vol 26, No 8, p 930-937, August, 1980. 4 Fig, 6 Tab, 28 Ref.

Descriptors: *Phytoplankton, *Mercury, *Toxicity, *Growth rates, *Fluorescence, Analytical techniques, Diatoms, Inorganic compounds, Organic compounds, Salts, Marine algae, Bioassay.

The effects on two species of marine planktonic algae (Nitzschia acicularis and Tetraselmis suecica) from the northwest coast of Spain of mercury in the form of inorganic salts ($HgC12$, $HgSO4$, or $NH2HgC1$) and organic salts ($CH3HgC1$ and phenylmercuric acetate, PMA) were assessed by means of growth kinetics and in vivo fluorescence monitoring. Mercury concentrations ranged from 0 to 1.6 ppm. Data was analyzed by linear regression and by correlation. Addition of mercury at a concentration of 0.05 ppm in any of the three inorganic forms resulted in diminution of the lag phase and/or an increase in exponential growth; both species reached a final cellular density similar to or higher than the control. A linear relationship existed for both species between duration of the lag phase and mercury concentrations in the form of $HgSO4$. The organic forms of mercury were more toxic than the inorganic forms for both species. N acicularis failed to grow at any of the test concentrations of PMA, and, at 0.05 ppm Hg, T. suecica indicated internal disorganization and loss of fluorescence. However, at 0.025 ppm Hg (PMA), this species indicated growth after 12 days of inactivity. For $CH3HgCl$, there was no growth for 15 days even at 0.025 ppm, the lowest concentration, though at the end of the experiment, 66% of T. suecica cells appeared enlarged. Higher concentrations of mercury that still permitted cell growth nevertheless affected chlorophyll fluorescence in central cellular areas, and the cells also appeared slimmed. (Gish-FRC)
W81-00210

LAKE GENEVA (LEMAN): RESTORING THE BALANCE,
Foundation Ripaille, Thonon-les-Bains (France).
E. Neckler.
Environmental Conservation, Vol 7, No 2, p 122-124, Summer, 1980.

Descriptors: *Lakes, *Lake Geneva, *Eutrophication, *Water pollution effects, *Nutrient removal, Conferences, Water pollution, Phosphorus, Nitrogen, Fertilizers, Herbicides, Pesticides, Oil pollution, Legislation, Water purification, Nutrients, Biological treatment, Chemical degradation, Sewage disposal, Agricultural runoff, Water pollution control.

The findings and conclusions of a symposium on the conservation and pollution problems of Lake Geneva are reported. Since the 1950s, the Lake has become eutrophic, mainly due to the constant influx of residual waters bearing excessive loads of nutrient elements, including nitrogen and phosphorus. Algae and phytoplankton have proliferated, the waters have clouded, and fish with low oxygen requirements are proliferating at the expense of those with high oxygen requirements. A network of water purification centers provides mechanical, chemical, and biological purification (the latter has now achieved 90% efficiency despite variation in sewage). Phosphorus is the worst pollutant of recent years, and to reduce this problem, France and Switzerland have banned the sale of washing powders with $<$ 80% biodegradability. Efforts are being made to educate farmers to use less fertilizer in an attempt to reduce mud effluent containing phosphorus and nitrogen. Weed killers and pesticides represent only 1% of fertilizers used in the Lake area and are not a pollution threat. Streams containing rains that fall on roadways contain salt and hydrocarbons in increasing amounts. The symposium was in favor of putting restraints on the horsepower of motorboats used on the Lake; means of controlling oil pollution are already in effect. The best hope of restoring the Lake to an acceptable degree of purity lies in alerting residents of the Lake area to the condition of the Lake and to the danger of its relapse. (Gish-FRC)
W81-00215

BIOCHEMICAL AND HEMATOLOGICAL EFFECTS OF A TITANIUM DIOXIDE INDUSTRIAL EFFLUENT ON FISH,
Swedish Environment Protection Board, Studsvik. Brackish Water Toxicology Lab.
A. Larsson, K.-J. Lehtinen, and C. Haux.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 427-435, September, 1980.

Descriptors: *Titanium, *Bottom fish, *Fish physiology, *Heavy metals, *Iron compounds, *Sulfur compounds, Acidic water, Acidity, Water pollution effects, Bioassay, Toxicity, Zinc, Lead, Cadmium, Copper, Industrial wastes, Brackish water

Flounders (Platichthys flesus) were exposed under continuous flow conditions for 14 days to 370 or 685 microliters/liter brackish water of titaniumdioxide industrial effluent from a plant on the southwest coast of Finland. The effluent contained 4% iron sulfate, 3% sulfuric acid, and heavy metal concentrations in undiluted effluent of 33.60 micrograms zinc, 0.22 micrograms lead, 0.12 micrograms cadmium, and 1.50 micrograms copper/liter. When discharged into the recipient water near the plant, the extremely acid effluent increases pH and results in precipitation of the heavy metals. Studies have demonstrated that the effluent is deleterious to bottom dwelling organisms and fishes; a brown precipitate formed on the gills of Perca fluviatilis and Alburnus alburnus when they were exposed to low concentrations of the effluent for 2-4 weeks. Exposure of flounder to the effluent resulted in enhanced levels of blood glucose ($p = 0.001$) and blood lactate ($p = 0.007$), and elevated levels of hematocrit and hemoglobin in females. The observed disturbances were attributed to strictly mechanical actions of the precipitate on gill tissue or a disturbed gill function caused by the biochemical action of heavy metals present in the precipitate. Hematological disturbances may be caused by stress induced by exposure to the effluent. (Lisk-FRC)
W81-00218

5D. Waste Treatment Processes

REMOVAL OF HYDROCARBON POLLUTANTS FROM WATER BY PROTOTHECA ZOPFII,
West Virginia Univ., Morgantown. Water Research Inst.
R. S. Pore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-110769, Price codes: A03 in paper copy, A01 in microfiche Technical Completion Report, 1980. 34 p, 5 Fig, 5 Tab, 12 Ref. OWRT-A-041-WVA (1), 14-34-0001-0152.

Descriptors: Algae, *Biological treatment, *Microorganisms, *Organic compounds, Treatment, Waste water treatment, *Water treatment, Aquatic microorganisms, Biodegradation, Ecosystems, Methodology, Microbial degradation, Organic wastes, Toxicity, Pollutants, Water pollution, Pesticides, Pesticide removal, Prototheca zopfii, Kepone

Bioaccumulation of Kepone and some other chemical pollutants from aquatic sources was

greatly enchanced by passage through a fixed-bed column containing the immobilized alga Prototheca zopfii. The living algae, immobilized in agar beads, removed the trace-level pollutants with an efficiency equal to or greater than activated charcoal. Hydrophobic partitioning was not the mechanism of bioaccumulation for the hydrophobic Mirex and Aflatoxin G (1) were not bioaccumulated, and metabolic inhibitors blocked bioaccumulation. The pollutants were stored, as the algae were incapable of biodegrading them. The pollutants with the greatest affinity for bioaccumulation were preferentially adsorbed in the presence of a mixture of different pollutants. The chemical recognition for bioaccumulation was very specific, and when it occurred, as in the case of Kepone, concentration factors on the order of 1,000,000 were obtained. The model system shows promise for several waste-water-treatment applications and for basic studies in bioconcentration.
W81-00016

THE SURVIVAL OF PATHOGENS DURING THE COMPOSTING OF WASTEWATER SLUDGE,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
M. N. Flinkstrom.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-109811, Price codes: A06 in paper copy, A01 in microfiche. Master of Science Thesis, 1980. 96 p, 16 Fig, 13 Tab, 23 Ref, 3 Append. OWRT B-006-NH (1), 14-34-0001-0272.

Descriptors: *Decomposing organic matter, *Domestic wastes, *Sewage treatment, *Aerobic treatment, *Streptococcus, Organic wastes, Sludge, Aeration, Municipal Wastes, Sewage, Solid wastes, Aerobic bacteria, Sewage bacteria, Coliforms, Pathogenic fungi, Biodegradation, Pathogenic bacteria, Composting, Sludge composting, Sludge treatment, New Hampshire, Forced aeration composting, Wastewater sludge disposal, Domestic wastewater sludge, Static pile composting.

Two complete composting periods, including active composting by static pile forced aeration and curing were monitored in this study. Samples from four sites representing interior and exterior portions of the compost pile were collected regularly. The survival of two groups of bacterial indicators, fecal coliform and fecal streptococcus, and one fungus, Aspergillus fumigatus, were monitored during the two composting periods studied. Temperature, pH, moisture content, and carbon:nitrogen ratio of the compost material were also monitored. Data collected indicated that the organisms studied here were virtually eliminated during the composting of raw wastewater sludge. Temperature within the compost mass had the greatest effect on the survival of the organisms, but many factors were responsible for the patterns of survival and destruction noted.
W81-00022

A TRIHALOMETHANE STUDY OF THE DURHAM, NEW HAMPSHIRE WATER TREATMENT PLANT,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W81-00033

THE EFFECT OF PROCESS DESIGN ON REDUCED WATER USE AND WASTE IN DAIRY PROCESSING,
North Carolina State Univ. at Raleigh.
R. E. Carawan, and W. J. Harper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-110330, Price codes: A11 in paper copy, A01 in microfiche. Water Resources Center. The Ohio State University, Columbus, Project Completion Report 502X. June 1980, 217 p, 18 Fig, 59 Tab, 218 Ref. OWRT-A-043 OHIO (2).

Descriptors: *Dairy industry, *Waste water treatment, *Sewerage, Model studies, Water pollution control, Costs, Industrial wastes, Municipal sewer system.

Procedures were developed for evaluating management and process modification in dairy plants to minimize water use and resource losses. The study utilized a medium sized, multi-product dairy plant as a model for the study. Water use, wastewater discharge, product loss and waste contribution was determined for each unit process. Waste parameters evaluated emphasized water volume, biochemical oxygen demand (BOD) and fats, oils and grease (FOD). Alternative processes were selected for reduction of water and wastes and evaluated for cost effectiveness. A linear program model was developed for the model plant on a unit processes basis and solutions obtained to evaluate the effects of process modifications, effluent restrictions and costs of water and waste discharges on cost effectiveness of the model plant and the model plant after process modifications. Without process modifications an effluent limitation of 2000 mg/l BOD would shut down ice cream and cottage cheese operations and results in a 75% reduction of milk processing. With all available process modifications, the plant could process 100% of milk and ice cream and 23% of the cottage cheese.
W81-00035

ANALYSIS OF THE CHEMISTRY ASSOCIATED WITH OZONOLYSIS OF ORGANIC POLLUTANT MOLECULES IN WATER,
Wesleyan Univ., Middletown, CT.
W. Pringle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115651, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, September 16, 1980. 8 p, 2 Fig, 12 Ref. OWRT-A-070-CONN(1).

Descriptors: *Water pollution, *Waste water treatment, *Chemical reactions, *Kinetics, *Toxins, *Analytical techniques, Assay, Waste treatment, Water quality, Water chemistry, Chemistry, Pollutants, Water pollution sources, Pollutant identification, Poly-chlorinated biphenyls, Water pollution treatment, Chemical analysis, Investigations, Chlorination.

This study sought to examine the chemistry and rates of chemical oxidation and to identify compounds residual from ozonation of organics identified in sewage treatment plant water. An all-glass system was constructed to ozonize aqueous solutions of trace organics, modified to contain quartz reaction cells for UV irradiation and to reduce sparging. Products and product yield rates were determined by instrumental analysis, including gas chromatography (GC), GC-mass spectrometry, pulsed Fourier transform nuclear magnetic resonance, and an assembled linear array photo-detector-computer system for laser-induced narrow-line low-temperature fluorescence spectra of trace organic concentrations. Toxic compounds studied for ozonation, oxidation products analysis, and reaction kinetics were phenol, the three chlorophenol isomers, dibenzofurane as a model for its toxic chlorinated analogs, and chloroform. Large differences were noted in the ozonolysis rates of the three chlorophenol isomers. It was also determinated that dibenzofurane ozonolysis was much faster in water than in organic solvents. Matrix isolation fluorescence was also examined as a trace technique for polycyclic aromatic hydrocargons. It was sought to study ozonolysis to determine conditions for removal of toxic or suspect carcinogens resulting from chlorine treatment of sewage organics. (Zielinski-IPA)
W81-00093

APPLICATION OF THE AEROBIC-MEDIA TRICKLING FILTER TO NITROGEN CONTROL IN WASTEWATER TREATMENT,
West Virginia Univ., Morgantown. Water Research Inst.
C. R. Jenkins, G. K. Bissonnette, P. B. Huff, and G. W. Gillespie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118762, Price codes: A03 in paper copy, A01 in microfiche. Information Report 14, 1980. 40 p, 11 Fig, 12 Tab, 54 Ref. OWRT-A-036-WVA(3), 14-34-0001-8052.

Descriptors: *Aerobic treatment, Equipment, *Nitrification, Oxygenation, *Sewage treatment, *Trickling filters, *Waste water treatment, Aeration, Biological treatment, Filters, Nitrogen, Oxygen, Secondary treatment, Solids contact processes, Treatment, Wastes, Waste treatment, Water pollution treatment.

Chemical and microbiological evaluation of a bench-scale aerobic-media trickling filter (AMTF) showed the system to be successful in promoting rapid nitrification of a synthetic secondary-treated sewage effluent. Efficient nitrification occurred for a variety of hydraulic and substrate-nitrogen loadings. Microbiological analyses of the pure oxygen fixed-film reactor indicated that the nitrification process is more dependent upon the activity levels of the nitrifying bacteria than on their absolute densities. Both heterotrophic and nitrifying bacteria were distributed throughout the entire depth of the AMTF without any distinct population profiles. Although pH depression occurred in the lower half of the reactor, nitrifying bacteria densities were not seriously affected. The reactor as constructed is competitive in terms of size and performance with most nitrification systems currently in use.
W81-00120

PROCESS FOR CONCENTRATING TRITIUM AND/OR TRITIUM HYDRIDE AND SEPARATING IT FROM TRITIUM WATER,
Hoechst A.G., Frankfurt am Main (Germany, F.R.).
H. Hesky, and A. Wunderer.
U.S. Patent No 4,190,507, 3 p, 1 Fig, 6 Ref. Official Gazette of the United States Patent Office, Vol 991, No 4, p 1362, February 26, 1980.

Descriptors: *Patents, *Waste water treatment, *Industrial water, *Tritium, Radioactive wastes, Water pollution sources, Electrolysis, Nuclear wastes, Tritium water.

A process for obtaining concentrated tritium and/or tritium hydride and separating it from tritium water is disclosed. In the reprocessing of spent nuclear fuel, the radioactive substance, tritium, in addition to other substances, is released. The tritium so obtained is in the form of tritium water which cannot be recycled and must be stored. Tritium water is intended to include a mixture of water, tritium hydroxide and di-tritiumoxide. Due to the radioactivity of tritium, the tritium water is decomposed into oxyhydrogen gas and tritium steam which must be stored under controlled conditions. By contrast, elemental tritium and/or tritium hydride can be stored without any need for controlled conditions provided that the generated heat is dissipated in a suitable manner. It is therefore, the object of this invention to obtain tritium and tritium hydride in high concentration. This problem is solved by increasing the concentration of tritium hydroxide and di-tritium oxide in the tritium water through distillation and then electrolyzing the enriched mixture. The mixture can be charged to an electrolytic enrichment cascade. The product of electrolysis, i.e., concentrated tritium, is stored and the oxygen is reduced by NO and worked-up to yield nitric acid, which is then used as a solvent in the reprocessing of spent nuclear fuel. (Sinha-OEIS)
W81-00126

PROCESS FOR REMOVING CHALCOPHILE ELEMENTS FROM AQUEOUS SOLUTIONS BY ELECTROLYSIS,
National Research Inst. for Metals, Tokyo (Japan). (Assignee).
H. Kametani, and T. Mitsuma.
No 4, p 1362, February 26, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial water, *Metals, Electrolysis, Separation techniques, Electrochemistry, Sulphides, Chalcophile.

Aqueous solutions containing ions of chalcophile elements are waste waters which occur in the refining and fabricating of metals and in the material industry. To prevent environmental pollution,

these industrial waste waters can be discharged after removing noxious elements, especially heavy metals. The invention provides a process for separating a chalcophile element from an aqueous solution by an electrolytic technique using elemental sulfur as a sulfidizing agent. The process comprises electrolyzing an aqueous solution containing one or more chalcophile elements in the form of ion as a catholyte under acidic conditions in the presence of elemental sulfur powder to precipitate the chalcophile element in the form of sulfide, and separating the precipitated sulfide from the aqueous layer. (Sinha-OEIS)
W81-00127

ELECTROCHEMICAL PROCESS FOR THE REMOVAL OF CONTAMINANTS FROM AQUEOUS MEDIUM,
Eastman Kodak Co., Rochester, NY. (Assignee).
C. M. Chaffin.
U.S. Patent No 4,190,509, 3 p, 8 Ref. Official Gazette of the United States Patent Office, Vol 991, No 4, p 1362-1363, February 26, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Metals, Separation techniques, Industrial wastes, Cooling water, Chromium, Electro-chemistry, Equipment, Regeneration.

Among the most difficult purification problems are those relating to removing small quantities of metallic or anionic radical contaminants from dilute aqueous solutions, such as rinse water from chrome plating operations and purge streams from cooling tower waters that contain hexavalent chromium Contaminating ions are removed from an aqueous media by an electrochemical method which includes formation of an insoluble iron compound or complex of the contaminant ion utilizing an anode of iron, iron alloy or insoluble iron compound. The hexavalent chromium contaminant, as chromate or dichromate, is changed to trivalent chromium, a less toxic form. Under continuous production operation it has been found that the electrical activity of the cell decreases with time requiring a regeneration of the system. Regeneration of the electrochemical cells can be accomplished without an acid backwash. This improvement consists of modifying the electrochemical cell so as to permit the periodic introduction into the cell of a volume of a compressed gas. Sufficient compressed gas should be provided to provide a thorough agitation throughout the cell. This compressed gas regeneration may be used as a total replacement for acid wash systems or it may be used in conjunction with the acid wash system to reduce the frequency of acid washing. (Sinha-OEIS)
W81-00128

PROCESS FOR BIOLOGICAL PURIFICATION OF WASTE WATER,
Stamicarbon, B. V., Gellen (Netherlands). (Assignee).
B. H. N. Dassen.
U.S. Patent No 4,190,528, 6 p, 2 Fig, 7 Ref. Official Gazette of the United States Patent Office, Vol 991, No 4, p 1368, February 26, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Biological treatment, Hydrolysis, Activated sludge, Temperature, Ammonia.

A process for the biological purification of waste water is described in which a suspension of the surplus sludge formed during the purification is hydrolyzed in a basic medium and at elevated temperatures. The process is carried out by giving the suspension of the sludge a pH value of between about 8 and about 11 and carrying out the hydrolysis in the presence of a volatile base at a temperature of between about 90 and 300 degrees. The base is removed from the hydrolysate formed after the hydrolysis has been terminated. Ammonia or a bound form, such as ammonium carbonate, is used as the volatile base. The ammonia that has been removed from the hydrolysate is returned to the hydrolysis stage. (Sinha-OEIS)
W81-00129

WASTE WATER FILTRATION AND SLUDGE REMOVAL SYSTEM,
Armco, Inc., Middletown, OH. (Assignee).
E. L. Wyatt.
U.S. Patent No 4,190,534, 9 p, 7 Fig, 6 Ref. Official Gazette of the United States Patent Office, Vol 991, No 4, p 1369-1370, February 26, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Filtration, Separation techniques, Water reuse, Sludge, Iron, Equipment.

The invention describes a waste water filtration and sludge removal system where the waste water produced by the types of steel treatment processes can be filtered to produce reusable wash water and an iron sludge having an acceptably low water content for convenient handling and possibly for use as a soil conditioner, etc. The system includes a trough-like filtering tank having weep holes along the lower edge draining into an inclined channel for capturing filtered water for reuse, and also includes a multiple layer filter bed containing an upper layer of fine jagged surfaced particles for capturing filtered sludge. The sludge layer deposited on the surface of the upper filter layer is periodically moved by means of an adjustable screed blade toward an elevated discharge station for removal from the tank without significantly disturbing the filter bed. The screed blade may be automatically raised out of contact with the sludge layer when operated in the reverse direction (Sinha-OEIS)
W81-00132

APPARATUS FOR ON-SITE RENOVATION OF SANITARY WATERS,
F. Besik.
U.S. Patent No 4,190,539, 6 p, 1 Fig, 6 Ref. Official Gazette of the United States Patent Office, Vol 991, No 4, p 1371, February 26, 1980.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water pollution treatment, Domestic wastes, Separation techniques, Oxidation, Chemical precipitation, Equipment

A self-contained apparatus for on-site renovation of sanitary waters comprises three bioreaction chambers, a mineral storage and dispensing container, a submerged suspended solids separator located in the third bioreaction chamber, a flow equalizer, a chemical oxidizing agent dispensing system, a chemical oxidation-clarification chamber and a charcoal containing chamber, all enclosed in a single tank designed for use as on-site single or multiple family waste water renovation system. (Sinha-OEIS)
W81-00134

WASTE WATER TREATMENT APPARATUS,
Aqua-Aerobic Systems, Inc., Rockford, IL. (Assignee).
T. B. Wade, and J. A. Knight.
U.S. Patent No 4,190,541, 8 p, 6 Fig, 5 Ref. Official Gazette of the United States Patent Office, Vol 991, No 4, p 1372, February 26, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Equipment, Cleaning, Settling basins, Sludge disposal.

A waste water treatment apparatus is described in which a carriage support rail extends across the top of the tank intermediate the side walls of the tank. A carriage is mounted on the rail and is driven by a carriage drive including an endless chain which reciprocates the carriage along the rail. A tank cleaning head is mounted on the carriage for movement along a path adjacent the bottom of the tank. The carriage support rail is in the form of a box-shaped beam having inwardly directed flanges at its underside and the chain is mounted inside the box-shaped beam to be protectively enclosed in the beam. The carriage has wheel mountings extending upwardly into the beam at opposite sides of the chain and carriage support wheels are mounted on the wheel mountings inside the beam and in rolling engagement with the flanges on the beam to support the carriage. The chain has upper and lower runs extending lengthwise of the tank and carries a drive lug The carriage has an upper and lower follower alternately engaged by the drive lug as it moves respectively along the upper and lower runs of the chain to reciprocate the carriage. (Sinha-OEIS)
W81-00135

WASTE WATER TREATMENT APPARATUS,
J. M. Pederson, and W. J. Beckman, Jr.
U.S. Patent No 4,190,543, 6 p, 5 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 991, No 4, p 1373, February 26, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Sewage treatment, Biological treatment, Flow control, Sludge disposal.

A waste water treatment apparatus and process is especially adapted for tertiary treatment of sewage where biological media panels are positioned in a treatment tank in a manner so that the formation of a stable mat or film composed of solids is established on them. Biological growth on the panels is enhanced while at the same time excessive solids build-up is avoided. Flow through the tank is directed in a generally horizontal fashion and sludge removal is accomplished by pump means (Sinha-OEIS)
W81-00136

ENERGY SAVING IN ACTIVATED SLUDGE TREATMENT,
Philadelphia Water Dept., PA.
C. F. Guarino, M. D. Nelson, M. Lozanoff, and T. E. Wilson.
Public Works, Vol 111, No 10, p 57-62, 94, October, 1980. 8 Fig, 5 Tab.

Descriptors: *Activated sludge, *Biodegradation, *Aeration, *Pilot plants, Submergence, Suspended solids, Biochemical oxygen demand, Performance, Evaluation, Sewage treatment, Municipal wastes, Waste water treatment.

The upgrading of a Philadelphia waste water treatment plant to provide secondary treatment by a process known as 'Surfact' is described. It was estimated that the Northeast plant conversion to Surfact, which took place in the 1970's, would save $50 million in operating costs over the plant's 20-yr life while reducing energy consumption by 33%. The process combined activated sludge treatment and rotating biological contactors. The objective of this phase of the program was to ascertain the capabilities of an air-driven system, but it was also discovered that microbial growth was increased as compared with mixed liquor solids. A prototype installation was set up in six different modes to provide variations in waste water temperature, effluent BOD, solids retention time, dissolved oxygen, flow rate and air consumption. Modifications were needed in 1978 to provide additional oxygen at a reduced air flow of 6000 cfm. A step feed system was also constructed. Pilot test results for two modes indicated BOD removals of 84% and 95%. As the solids retention time goes past 5, leveling occurs in the amount of removal. A typical effluent suspended solids level at the Northeast plant would be in the range of 110-120 mg/liter To allow all discs to carry maximum growth levels, a proper combination of mixed liquor flow and loading was necessary. In biological studies, the Surfact adaptations produced an aerobic system with flagellates, swimming ciliates, and stalked ciliates. Settling tests showed that sludge in the prototype settled best at high overflow rates Optimum disc rotation was 1.5 rev/min. Use of disc solids aided energy conservation. Initial settling velocities of 19 ft/hr were possible. The construction time for upgrading to Surfact was estimated to be minimal. (Geiger-FRC)
W81-00220

INDUSTRIAL TECHNOLOGY ADAPTED TO MUNICIPAL SLUDGE DRYING,
For primary bibliographic entry see Field 5E.
W81-00221

SWEDISH WASTEWATER TECHNOLOGY SETS FAST PACE,
Water and Sewage Works, Vol 127, No 9, p 68, 71-72, 77, September, 1980. 4 Fig, 2 Tab.

Descriptors: *Waste water treatment, *Sweden, *Technology, *Treatment facilities, *Biological treatment, Chemical degradation, Sewage treatment, Biochemical oxygen demand, Nutrient removal, Municipal wastes.

Advancements made over the past 10 yr in Sweden regarding treatment of waste water are reviewed. One of the problems which had faced the Swedish government in 1969 was the level of phosphorus in the water. Biological/chemical plants constructed to meet this challenge are today producing waste waters with at least 98% removal of BOD and phosphorus. Most plants are operating at moderate costs due to success in design engineering and reliability of equipment. Turnkey operations have eliminated fault finding. The contractors assume all responsibilities for the first year of operation and they also train the staff that will eventually take over operations. Specific plants are described that are located at Hoor, Findus, and Malmo. Some other plants are not operated on the turnkey system. Two of these which are described are the plant at Hassleholm, and the one at South Stockholm, Henriksdals. One method currently under study calls for treating sediment to function as an ion exchanger where lime addition is not effective. Novel gasketing systems which have been designed for the Swedish systems are also described. (Baker-FRC)
W81-00223

DESIGN AND ECONOMIC CONSIDERATIONS OF GAC SYSTEMS,
Philadelphia Water Dept., PA.
C. F. Guarino, J. V. Radziul, P. R. Cairo, D. D. Blair, and M. M. Pence.
Water and Sewage Works, Vol 127, No 9, p 58-59, 63-64, 66-67, September, 1980. 4 Fig, 13 Tab, 8 Ref.

Descriptors: *Activated carbon, *Computer models, *Economic efficiency, *Treatment facilities, *Design criteria, *Evaluation, Costs, Capital costs, Operating costs, Maintenance costs, Water treatment, Water purification, Granules, Filtration, Chlorination, Pilot plants, Delaware River.

A flexible computer model was used to evaluate modifications to EPA granular activated-carbon (GAC) design criteria. The cost model was calibrated with data from literature, manufacturer's costs, and information based on GAC facilities in use. Pilot studies were conducted at the Torresdale (Philadelphia) plant where prechlorinated, clarified and filtered water from the Delaware estuary was applied to columns operating at empty bed contact times. Influent and effluent from these columns were analyzed. Major design parameters considered in the economic analysis of GAC post-contactor treatment included various capital items, operation and maintenance costs, and financial items. Major capital costs were the initial carbon, pumping station, contactors, and regeneration facility. Of the operation and maintenance costs, carbon to compensate for the 7% loss was most significant. Analysis of the effects of inflation for various contact times revealed that shorter contact times were more economical with lower rates of inflation. Comparison pilot studies indicated that the proposed EPA design criteria produced a similar bed life for the same contact time in both sand-replacement and post-contactor GAC operations. It is noted that, if a criterion for bed life that is able to discern performance levels between the two systems is developed, the post-contactor system may be more economical than sand replacement. (Baker-FRC)
W81-00224

ION-EXCHANGE BEDS DEFY ORGANIC FOULING,
Belco Pollution Control Corp., Parsippany, NJ.
R. J. Cichon, R. B. Trattner, and P. N. Cheremisinoff.
Water and Sewage Works, Vol 127, No 9, p 48-49, 54, 100, September, 1980. 4 Fig, 4 Tab.

Descriptors: *Ion exchange, *Resins, *Filtration, *Adsorption, *Activated carbon, Organic acids, Fulvic acids, Cation exchange, Anion exchange, Organic wastes, Municipal wastes, Waste water treatment.

The design of ion-exchange beds to withstand organic fouling is described. Field testing is essential because organic matter can consist of such compounds as humic and fulvic acids. The object in ion-exchange is to remove inorganic impurities by demineralizing with simultaneous decolorization by removing anionic color bodies. Various ion-exchange resins were tested with and without activated carbon filtration to determine benefits from ion-exchange as an organic scavenger. The fouling of resins results in poor resin kinetics. Severe fouling results in an increase of dissolved-solids leaking through as flow rate increases and a gradual breakthrough pattern at exhaustion. Six types of mixed beds and streams were tested: isolated, layered, mixed bed; activated carbon and layered, mixed bed; organic trap (S-37) and layered bed; organic trap (A-340) and layered bed; organic trap (IRA-68) and layered, mixed bed; and activated carbon, organic trap (S-37), and layered, mixed bed. The two streams and beds which were most effective were: organic trap (S-37) and layered bed; and activated carbon, organic trap (S-37) and layered mixed bed. Organic matter did not hinder performance of properly structured beds containing ion-exchange resins. (Baker-FRC)
W81-00225

CHEMICALS SUBSTITUTE FOR BIOLOGICAL TREATMENT,
Clark County Sanitation District Las Vegas, NV.
J. H. Parrott.
Water and Sewage Works, Vol 127, No 9, p 36-37, 105-106, September, 1980. 1 Fig, 1 Tab.

Descriptors: *Treatment facilities, *Chemical degradation, *Flocculation, *Sludge treatment, Biochemical oxygen demand, Suspended solids, Trickling filters, Phosphorus, Construction, Separation techniques, Waste water treatment, Waste water disposal, Municipal wastes.

District flow projections in 1975 showed that the Flamingo Road facility of Clark County, Nevada would need a new operation system to handle the rapidly expanding community by 1979. Initial tests indicated that chemical additions would be needed to meet new discharge limitations. The west plant was chosen as the test site over the east plant and its secondary system and trickling filters are described. Energy from the downstream side of the recirculation box leading to a secondary clarifier could be used at the west plant. A 4000 gal pool was erected near the recirculation box and a metering pump was placed at the box and by a manhole 100 ft downstream from the recirculation box. Results showed that high BOD and suspended solids removals were possible. Dosage rates of 100 mg/liter of ferric chloride and 150 mg/liter of alum gave 15 mg/liter BOD, 15 mg/liter suspended solids and 1 mg/liter P or better. After full plant tests, the state agreed to an increase of 36 mgd. A fully automated system was implemented with central monitoring chemical and polymer feed pumps for both the east and west facilities. During full scale operation, the clarity of the secondary clarifiers without chemical additions was poor, but after chemical additions and flocculation, water became quite clear. A consent decree changed the January 1, 1981 discharge limitations to 30 mg/liter BOD, 30 mg/liter suspended solids, and 1 mg/liter P. Preliminary tests show that 10, 10 and 1 mg/liter for BOD, suspended solids and P are attainable, respectively. Projected costs of operation for the new system are $92/million gal of discharge. The only foreseeable problems will be with sludge removal and disposal. (Geiger-FRC)
W81-00227

BIOLOGICAL FLUIDISED BED TREATMENT FOR WATER AND WASTEWATER - A REVIEW OF THE WRC/UMIST CONFERENCE,
Water Pollution Research Lab., Stevenage (England).
P. Cooper.
Water Services, Vol 84, No 1014, p 475-476, 479-480, August, 1980. 3 Fig, 4 Ref.

Descriptors: *Biological treatment, *Biodegradation, *Sands, *Research and development, *Fluid mechanics, Porous media, Conferences, Waste water treatment, Industrial wastes, Sewage treatment, Water treatment, Suspended solids, Potable water, Oxidation, Anaerobic conditions, Engineering, Economics, Particle size, Biological fluidized beds.

This conference was the first conducted on all aspects of biological fluidized bed (BFB) water treatment. Papers discussed the basic principles of BFBs, the use of BFBs in the treatment of potable water, of sewage, and of industrial effluents, the treatment of settled sewage by anaerobic BFB systems, the process engineering of BFBs and the pilot-plant experiences of two companies that will soon be selling BFB systems, and the economics of BFBs compared with activated sludge systems. The first reported work on the performance of BFBs under diurnal-flow and variable-load conditions was presented, and it was concluded that a carefully designed plant could overcome these problems. A unique two-phase system in which air was used as the oxygen source was described. Several conclusions were drawn. Sand was the most widely used solid medium for two-phase systems. The cost of oxygen is a major problem in the United Kingdom but not in the USA; anaerobic treatment may prove more feasible. More information on media/biomass separation and BFB performance under nitrifying conditions is required. The start-up of reactors is not such a major problem as was previously thought. A liquid distribution system described at the conference may be suitable for full-scale plants. The implementation of full-scale plants is still needed. (Gish-FRC)
W81-00238

CLEANER TYNE.
Water Services, Vol 84, No 1014, p 467-469, 471-472, August, 1980. 12 Fig.

Descriptors: *Sewerage, *Interceptor sewers, *Settling basins, *Telemetry, *Treatment facilities, Sewage treatment, Sewers, Water pollution, Waste water treatment, Rivers, Sewage disposal, Screens, Sludge disposal, Instrumentation, Aeration, Planning, Municipal wastes, Control systems.

The 107-million pound Tyneside Sewerage Scheme to reduce pollution in England's River Tyne is described. The project, which is more than 60% complete, involves the construction of interceptor sewers running parallel to the river and coastline which will intercept > 100 existing discharges to convey the sewage to the Howdon Sewage Treatment Works (HSTW). Sewage from the river's south bank will flow to the Preliminary Treatment Works at Jarrow (JPTW) on the south bank, where it will be directed under the river to the HSTW. Sewage from the north bank will flow directly to HSTW. The total length of the sewers will be approximately 75 km. JPTW incorporated coarse bar screens followed by fine bar screens, a Geiger press, and aerated spiral flow grit channels to remove grit particles > or = 0.2 mm in diameter. HSTW is designed for a future population of one million and in the first stage will provide for the removal of screenings and grit followed by sedimentation. There are 12 sedimentation tanks, each with a capacity of 7,400 cu m. A computer with telemetry equipment provides communication between HSTW and 118 outstations at remote plant centers, pumping stations, treatment works, and flow measurement stations. Sludge collected at HSTW will be transported by a sea-going vessel (capacity: 1,500 tons sludge, 50 tons grit) for dumping at sea. Sufficient land exists for a secondary treatment plant to be built at Howdon if necessary. (Gish-FRC)
W81-00239

FOOD PROCESSING WASTES MANAGEMENT,

Russell Research Center, Athens, GA.
W. K. Whitehead.
Agricultural Engineering, Vol 61, No 8, p 26-27, August, 1980. 3 Fig.

Descriptors: *Food processing industry, *Waste water treatment, *Waste water reclamation, Industrial wastes, Aerobic treatment, Irrigation, Lagkoons, Land treatment, Biochemical oxygen demand, Water conservation, Water reuse, Pretreatment(Water), Sewage treatment, Organic wastes, Water pollution sources.

Methods for conservation and efficient use of water by food-processing plants are identified. Waste water, the most difficult byproduct of food-processing operations to dispose of, can be partially reclaimed in caning operations, which can reduce water use by 30%, as well as almost eliminate the need for water softeners and lower water heating requirements. Ways in which food processing plants control pollution are inhouse control (including water conservation) and pretreatment or full treatment prior to discharge. Secondary treatment appropriate in rural areas include aerobic lagoons, which have a sporadic performance, and land application, which is not yet in common practice. All reduce organic loading to streams. The choice of method is a function of plant location and economic factors including costs related to waste management regulations. (Titus-FRC)
W81-00241

ONSITE WASTEWATER TREATMENT FOR A RECREATION AREA,
ADI Ltd., Fredericton (New Brunswick).
T. Viraraghaven, R. C. Landine, and G. H Jenkins.
Public Works, Vol III, No 10, p 63-64, October, 1980. 1 Fig.

Descriptors: *Recreation facilities, *Septic tanks, *Tile drainage, *Domestic wastes, Waste water treatment, Sanitary engineering, Sewers, Tile drains, Sumps, Waste water disposal.

A system was designed to handle waste water treatment at the Cavendish Beach recreation area on Prince Edward Island National Park. The system was to handle 13,200 Imperial gallons (Igal) per day with the flow being generated over a period of 8 hrs. Various onsite treatment alternatives were considered including package or other mechanical treatment plants with a surface discharge of effluent, two-cell stabilization pond with surface discharge of effluent, spray irrigation, or septic tank-tile field system. The fourth choice was the one installed. The 400-foot 8-inch gravity sewer running from the changehouse/concession facility to the septic tank has a maximum flow of 66 Igpm. The septic tank capacity is 14,000 Igal in two compartments with minimum volume being equivalent to the daily flow. Sump capacity is 1,250 Igal, 75% of the volumetric capacity of tile in one field. Soil in the three tile beds consisted of sandy silt with relatively low permeability. The system has a rest period of 8 months a year and 12 to 16 hr during the daily operation in the summer. (Baker-FRC)
W81-00242

FEEDING OF PRESSURE FILTERS,
Effluent and Water Treatment Journal, Vol 20, No 8, p 399-401, August, 1980. 4 Fig.

Descriptors: *Filters, *Pressure, *Flow, Mechanical properties, *Sludge treatment, Dewatering, Separation techniques, Bulk density, Pumps, Treatment facilities, Filtration, Flow resistance, Waste water treatment.

The designing of feed systems to serve pressure filters is discussed. Feed requirements for a filter designed to serve and operate under a given set of conditions are highly predictable. These requirements are related to the size of the filter, the dry solids level of the cake to be produced, the density of the individual sludge particles, the length of the filtration cycle, and the concentration of the conditioned sludge to be supplied to the filter. Pilot testing will provide the needed information. During initial operation, the mechanical design of the filter and its piping will determine the resistance to the flow through the filter. However, soon the permeability characteristics of the conditioned sludge will become the dominant influence and the flow to the end of the cycle will be greatly influenced by that permeability. An example is given in which a Willett model 12/150/34/B is used to feed a filter. (Baker-FRC)
W81-00248

DISC DIFFUSERS,
Effluent and Water Treatment Journal, Vol 20, No 8, p 393, 395, August, 1980. 2 Fig, 1 Tab

Descriptors: *Aeration, *Diffusion, *Bubbles, *Sludge treatment, *Pores, Disc diffusers, Porosity, Injection, Air circulation, Activated sludge, Testing, Oxygenation, Ozone, Waste water treatment.

The Degremont DP203 porous ceramic diffuser is a 230-mm diameter disc, 19 mm in thickness and composed of a blend of corundum grains bonded together using ceramics. The disc is used for the diffusion of clean oil-free gases into liquids, and for aeration of activated sludge where low noise levels, flexibility of operation, ease of maintenance and high oxygenation are important. It may also be applied to obtain optimum contact conditions for ozonization of potable water, industrial effluents, and sewage. The new disc with flat surface is compared with the earlier dome diffuser. The disc provides 60% more surface area than the dome and has perpendicular edges that provide greater oxygenation capacity. It can support a vertical load of 400 kg and diffuse clean, oil-free air into the liquid in a column of bubbles 2 to 3 mm in average diameter at a height of 50 mm above the surface of the disc. Tests carried out by the Water Research Centre and Degremont to assess disc performance showed that at a depth of 4 m and a flow rate of 3.3 cu mm/hr/disc, the oxygenation efficiencies in clean water ranged from 5.41 to 5.56 kg oxygen/kwh. In a larger tank, slightly poorer oxygenation efficiencies were observed. Experiments comparing discs and domes providing the same surface area under identical operating conditions resulted on the average in a 10% higher oxygenation efficiency when the discs were used. (Geiger-FRC)
W81-00250

5E. Ultimate Disposal Of Wastes

INDUSTRIAL TECHNOLOGY ADAPTED TO MUNICIPAL SLUDGE DRYING,
Public Works, Vol 111, No 10, p 51-53, October, 1980. 4 Fig.

Descriptors: *Treatment facilities, *Incineration, *Sludge disposal, *Solid wastes, Dewatering, Oxygenation, Coagulation, Steam, Cryogenics, Drying, Waste water treatment, Sludge treatment.

The implementation of municipal sludge drying is part of a $27.5 million waste water treatment project in Harrisburg, Pennsylvania. The city's improved and expanded facility is an energy recovery system which will upgrade the sewage treatment and water quality, help provide a solution to solid waste and sludge disposal problems, and generate more than a million dollars per year through the use and sale of steam for district heating and recycled metal. Design considerations included a 65-mgd settled sewage pumping station, three four-stage oxygenation tanks, cryogenic oxygen generating equipment, two flash mixing tanks to add alum, six rapid sludge removal final settling tanks, a return sludge pumping station, two gravity thickeners, one new chlorine contact tank, and two sludge digesters. Currently the incinerator does not fall under the stipulations of the Federal Air Quality Act. However, state standards are being met or exceeded by the use of electrostatic precipitators. At full capacity the incinerator will process 720 tons/day of solid waste and 35 tons/day of sludge, resulting in a residue of 7% of the original volume. (Baker-FRC)
W81-00221

FLUID BED INCINERATION,
R. J. Sneyd, and D. T. Mayrose.
Water and Sewage Works, Vol 127, No 9, p 38-40, 44-45, September, 1980. 7 Fig, 6 Tab.

Descriptors: *Sludge disposal, *Incineration, *Heat exchangers, *Ultimate disposal, Sludge treatment, Drying, Mechanical enginering, Dewatering, Separation techniques, Treatment facilities

Use of fluid bed incineration in the design of the West German Marienfeld sewage treatment plant and other such plants under construction in North America is reviewed. A fluid-bed reactor consists of three basic sections. The upper is the area for disengagement of the bed material from the upmoving air stream. The fluidized bed boils rapidly, providing the extreme mixing which is important for good combustion. Feeding sewage sludge into the fluidized mass is normally accomplished with either screw feeders or positive displacement pumps. Complete combustion of the sewage sludge takes place within the bed in less than one minute with only 40% excess air. Early fluid-bed incineration systems made use of the cold-windbox design. This design is discussed and compared with the hot windbox concept which is essentially similar except for the addition of a heat exchanger. Various types of gas scrubbers may be employed With vacuum filters or centrifuges, cakes of sludge with a primary-to-secondary sludge ratio of at least 50% are sent to incineration with 18-22% dry solids. Various advantages of using fluidized beds are detailed. Environmental compatibility and size selection are considered. (Baker-FRC)
W81-00226

LONG SEA OUTFALL UNDER CHESIL BEACH.
Water Services, Vol 84, No 1014, p 540-541, August, 1980. 3 Fig

Descriptors: *Outfall sewers, *Pipelines, *Pipe flow, *Sewage disposal, *Sites, Oceans, Ultimate disposal, Sewerage, Treatment facilities, Discharge lines, Construction, Pumping, Waste water treatment, Municipal wastes, Waste water disposal.

The remodeling of the Weymouth, Portland, and Wyke Regis sewage disposal facilities in England was carried out in the late 1970's. The sea discharge of both outfalls was just 300 m off the harbor mouth, a distance considered too short by modern standards. A study of inland treatment options which examined seven sites uncovered one site at Wyke Castle as a suitable place to begin tunneling. The discharge from this point would be 400 m offshore from Chesil Beach, however expenses for the plan were too high. Offshore and onshore studies up to the design stage were carried out and it was decided that all existing outfalls with flows intercepted and sent to Wyke Regis would be eliminated. The new outfall at Weymouth will be 2.7 km long and 1.68 m in diameter It will have 10 diffusers at 4.5 m intervals each with twin 250 diameter jets. Incoming solids will be reduced to under 5 mm diameter by the headworks and screenings will be stored until removal by tanker. Most of the headworks housing will be underground so that it will not be visible to nearby residents. Outfall flow will be by gravity and it was reported to be 415 m out at the author's last visit to the facility. Water from an aquifer was found in the shaft and tunnel, but this was remedied by pumping. Further reports on the project covering the outfall and headworks are expected. (Geiger-FRC)
W81-00231

FEEDING OF PRESSURE FILTERS.
For primary bibliographic entry see Field 5D
W81-00248

DIRECT POLYMER INJECTION,
Effluent and Water Treatment Journal, Vol 20, No 8, p 397, August, 1980. 1 Fig

Descriptors: *Sludge treatment, *Dewatering, *Polymers, *Injection, *Ultimate disposal, Polyelectrolytes, Treatment facilities, Municipal wastes,

Pumps, Mechanical engineering, Mechanical equipment, Compaction, Compressibility.

The use of polyelectrolytes for the dewatering of sludge in filter presses is rapidly replacing other conventional chemicals. Composting is also being used in many countries with the aid of polyelectrolytes. Early attempts at sludge injection with polyelectrolytes were unsuccessful due to the use of costly separate metering pumps. On a two pump system operating on the same principle as the Willett ram pump, sludge could be sucked in on one pump while the auxillary pump was on the delivery stroke. This pumping unit allowed for adjustments to compensate for day-to-day changes in the rate of dose to dry solids. The system calls for no extra electrical control equipment and may be easily installed to existing systems. The output of filter presses can be increased by improvements in polymer stability and application methods. Results so far from municipal and industrial installations in the United Kingdom on such systems show that improved throughput has been achieved through reduced cycle times. Pre-fill pumps with closed discharge on the bottom filtrate outlets are recommended for new installations. Better moisture distributions and reduced risk of blockages are avoided by prefilling the presses with final effluent to prevent pre-filtration within the press. (Geiger-FRC)
W81-00249

5F. Water Treatment and Quality Alteration

PRODUCTION, FATE AND REMOVAL OF TRIHALOMETHANES IN MUNICIPAL DRINKING WATER SYSTEMS,
Tennessee Univ., Knoxville.
R. A. Minear.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112443, Price codes: A12 in paper copy, A01 in microfiche. Water Resources Research Center, University of Tennessee, Research Report No 78, April 1980. 253 p, 39 Fig, 44 Tab, 69 Ref, 8 Append. OWRT-A-051-TENN (1), 14-34-0001-0145.

Descriptors: *Trihalomethanes, *Chloroform, Dichloromonobromomethane, Dibromomonochloromethane, Bromoform, Bromide, Humic Acids, *Gas chromatography, *Potable water, *Municipal water, Water treatment.

A two phase project has been conducted that began with a survey of 33 Tennessee drinking water supplies in which the levels of trihalomethanes in the finished water were assayed quarterly for one year. Summer concentrations were found to be much higher than for the other seasons with just less than half of the supplies exceeding 100 mg THM per liter. Only four systems averaged in excess of 100 mg/l for the four quarters and three others were just under this value. Surface raw water sources represented all high THM values while spring and well water sources were typically very low in THM content. NVTOC was found to be strongly related to the THM levels. When THM values were higher, chloroform was the dominant species, however, in a number of systems, bromine containing species were high and frequently the dominant forms. The second phase of the project was an outgrowth of attempts to decipher the variable species distribution. The results indicated that bromide can be an important factor in THM formation.
W81-00011

THE INFLUENCE OF FULVIC ACID ON CU2+, CD2+ AND ZN2+ REMOVAL FROM DRINKING WATER BY ALUM COAGULATION AND CU2+ AND CD2+ COMPLEXING CAPACITY MEASUREMENTS OF FULVIC ACID AND NATURAL FRESHWATER SAMPLES BY DIALYSIS TITRATION,
New Hampshire Univ., Durham. Dept. of Chemistry.
R. E. Truitt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-111262, Price codes: A09 in paper copy, A01 in michrofiche. PhD Dissertation, 1980. 163 p, 27 Fig, 16 Tab, 133 Ref, 1 Append. OWRT B-004-NH (3), 14-34-0001-8132.

Descriptors: *Water treatment, *Dialysis, *Fulvic acid, Metals, Humics, *Heavy metals, Copper, Cadmium, Zinc, Drinking water, Separation techniques, *Statistical experimental design, Metal ion binding, Complexing capacity, Dialysis titration, Alum coagulation.

Two studies of metal ion complexation by humic material were conducted. In the first, Cu super 2+, Cd super 2+ and Zn super 2+ removal from solution during alum coagulation treatment was measured in the presence and absence of soil-derived fulvic acid (SFA). In a statistically designed experiment, it was found that 6-96% Cu super 2+, -6 to 59% Cd super 2+, and -7 to 82% Zu super 2+ losses were effected. The significant variables were ph, alum dosage, and an interaction effect of SFA level with both ph and alum dosage. In the second study, a dialysis titration technique for the measurement of natural water Cu super 2+ and Cd super 2+ complexing capacity was critically evaluated. Complexing capacities of 6.25 M EDTA, 15.5 M SFA, and 7 freshwater samples were measure. No more than 10% of the SFA binding material permeates the dialysis membrane. Correlation of several water properties reveals that only the Cu super 2+ titration results correlate with ph, alkalinity, hardners and conductance. Color and DOC do not correlate with any water property.
W81-00027

OPTIMUM ALUM DOSE SELECTION FOR THE DURHAM WATER TREATMENT PLANT,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
W. J. Gallot.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-110348, Price codes: A07 in paper copy, A01 in microfiche. Master of Science Thesis, 1980. 136 p, 41 Fig, 14 Tab, 40 Ref, 9 Append. OWRT B-005-NH (2), 14-34-0001-9122.

Descriptors: *Fulvic acid, *Water treatment, Water quality, *Turbidity, *Potable water, New Hampshire, Drinking water, Coagulation, Flocculation, Sedimentation, *Alum, *Color removal, Linear regression equations, Humic substances, Organic color, Raw water quality, Fulvic acid concentration, Absorbance, Aluminum concentration, Suspended material, *Durham(NH).

The purpose was to determine the relationship between the raw water quality and the optimum alum dose for a color removal process. Jar tests were performed on water samples collected at the Durham Water Treatment Plant reservoir. The residual apparent color, apparent fulvic acid concentration, turbidity, absorbance and aluminum concentration were measured. Glass fiber filters were used to simulate the filtration step of the treatment process. A methodology was developed for the selection of the optimum alum dose. The methodology took into account chemical costs, operation costs and the regulatory guidelines and standards for color and turbidity removal. In the majority of the jar test results, the optimum alum dose selection was controlled by color removal. That is when the residual color was minimized the optimum alum dose had been reached. In the remaining jar tests, turbidity removal controlled the optimum alum dose selection. In order to utilize these results in an optimum control strategy, linear regression equations were estimated for the selection of alum dose as a function of the raw water quality. In addition, since ph adjustment is important for optimal performance of the color and turbidity removal process, regression equations for phcontrol were also developed. The effects of temperature upon the control strategy are discussed. Since an automatic control scheme is perceived, the raw water absorbance was used as a surrogate measure of the raw water color. The application of these equations to practical plant operations are discussed.
W81-00028

INFLUENCE OF PH ON DOSAGE REQUIREMENTS OF FERRIC CHLORIDE,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
E. P. Galarraga.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-110355, Price codes: A04 in paper copy, A01 in microfiche. MS Thesis, 1980. 55 p, 17 Fig. OWRT-A-108-NC (1), 14-34-0001-9035.

Descriptors: *Coagulants, *Water supply, *Water treatment, *Hydrogen ion concentration, Chemical precipitation, Ferric chloride, Turbidity removal.

This study investigates the feasibility of reducing the dosage requirement of ferric chloride for the removal of colloidal particles from waters containing low alkalinity by manipulating the pH control of the coagulation process. When metallic salts such as ferric chloride are used as coagulants, the solution pH needs to be maintained at an optimum level to allow the formation of hydroxopolymers or hydroxide precipitates from the added coagulants. Since the chemical reactions result in reduction the solution pH, bases are simultaneously added to maintain a constant pH at the optimum level. The results of laboratory studies indicate that a two-step pH control method can achieve the same removal efficiency as the constant pH method, but at lower dosage requirements. The new two-step pH control technique investigated allows the solution pH to drop to lower levels (e.g. 3.5) during the addition of ferric chloride. It is then adjusted back to the optimum level with the addition of bases. Savings of 15-52% ferric chloride can be obtained, depending on the initial solids concentrations. If the water to be treated contains high suspended solids but low alkalinity, the optimum dosage level of ferric chloride required will be sufficient to reduce the water pH to the desired low levels (e.g. 3-4). Thus, savings of ferric chloride can be achieved simply by delaying the addition of bases required for pH adjustment.
W81-00029

THE CHARACTERIZATION OF FULVIC ACID FRACTIONATED BY GEL PERMEATION CHROMATOGRAPHY,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
R. Bixby.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113896, Price codes: A06 in paper copy, A01 in microfiche. Master of Science Thesis, 1979. 91 p, 14 Fig, 13 Tab, 59 Ref, 5 Append. OWRT-A-048-NH (2), 14-34-0001-8031.

Descriptors: *Fulvic acids, *Water treatment, *Chemical analysis, *Chromatography, Spectroscopy, Coagulation, *Humic substances, *Chlorinated organics, Gel permeation chromatography, Trihalomethanes, Aluminum sulfate, Chemical structure, Infrared spectroscopy, Ultraviolet spectroscopy, Nuclear magnetic resonance spectroscopy, Hypochlorous acid.

Fulvic acid, the major component of naturally occurring humic substances in water, is both a precursor of chlorinated organics in drinking water and the source of organic color in surface waters. The purpose of this study was to isolate and characterize components of fulvic acid, and relate these findings to water treatment practices for the removal of color, primarily coagulation with aluminum sulfate. Fulvic acid was fractionated into four fractions by gel permeation chromatography. Chemical characterization of each fraction included carbon, hydrogen, nitrogen, water, and ash analyses. The structures of the fulvic acid fractions were elucidated by the use of infrared, ultraviolet, and nuclear magnetic resonance spectroscopy. An aluminum binding study was performed to gain insight into the mechanism of fulvic acid removal during coagulation. The fractions were isolated and found to be discrete components of fulvic acid with different chemical and structural characteristics. Test results indicated that the smallest molecular weight fraction was the most homogeneous, being primarily an aromatic substituted with carboxylate functional groups, and was able to com-

plex more aluminum than any other fraction. It was concluded that fulvic acid cannot be completely nor selectively removed during coagulation with aluminum sulfate, and thus, trihalomethanes will always be produced during disinfection with hypochlorous acid.
W81-00031

MIXED-FORM POLYHALIDE RESINS FOR DISINFECTING WATER,
Aqua-Chem, Inc., Milwaukee, WI. (Assignee).
G. L. Hatch.
U.S. Patent No 4,190,529, 4 p, 4 Tab, 7 Ref. Official Gazette of the United States Patent Office, Vol 991, No 4, p 1368, February 26, 1980.

Descriptors: *Patents, *Water treatment, *Disinfection, Water purification, Bactericides, Anion exchange.

The invention relates generally to the art of water disinfecting and in particular to the use of a bactericidal mixed-form polyhalide resin. A strongly basic anion-exchange resin loaded with iodine and a less than stoichiometric amount of an iodide salt or bromine and a less than stoichiometric amount of bromide sale is an effective demand bactericide for disinfecting water. The bactericidal resin elutes only small amounts of halide ions and is especially suited for killing bacteria in feed water supplies having relatively high salt content. (Sinha-OEIS)
W81-00130

AN AQUATIC FUNGUS FOR BIOLOGICAL CONTROL OF MOSQUITO LARVAE,
Clemson Univ., SC. Water Resources Research Inst.
C. J. Umphlett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119307, Price codes: A03 in paper copy, A01 in microfiche. Report No 79, November, 1979. 44 p, 40 Fig, 54 Ref. OWRT-A-031-SC(1).

Descriptors: *Aquatic fungi, *Biocontrol, *Pest control, *Insect control, *Mosquitoes, *Treatment facilities, Freshwater fungi, Fungi, Aquatic life, Aquatic microorganisms, Water pollution sources, Microbiology, Aquatic insects, Testing, Testing procedures, Larvae, Insect eggs, Larvae growth stage, On-site tests, Mortality.

This study sought to evaluate the use of a low level dose of an aquatic fungus, Lagenidium giganteum (LG), for the control of larvae of the Culex pipiens quinquefasciatus (CPQ) mosquito. While the overall project commenced in 1973 with construction completion of an outdoor screened-in test facility in 1974, and establishment of a CPQ colony in 1975, the present report presented information on data collected in the Spring, Summer, and Fall of 1976. Egg counting, pH, air/water temperatures, relative humidity, and fungal introduction were all controlled by the study protocol. Three weeks after inoculation of new CPQ mosquito pools with LG fungus, the adult population had been dramatically reduced in the test chambers. The larvae and pupae were carefully screened to insure that competing parasites were absent. It was concluded that LG can be a significant force against culicine mosquitos when applied and managed properly. Serious consideration for a research program was recommended, including large-scale field testing, which would include development of a type of inoculum and a delivery system suited to large-scale operations. Field testing must be done for the good prognosis observed for LG for population management of selected mosquitoes species to be realized. (Zielinski-IPA)
W81-00198

INACTIVATION OF COXSACKIEVIRUSES B3 AND B5 IN WATER BY CHLORINE,
North Carolina Univ. at Chapel Hill. Dept. of Bacteriology.
H. Jensen, K. Thomas, and D. G. Sharp.
Applied and Environmental Microbiology, Vol 40, No 3, p 633-640, September, 1980. 11 Fig, 1 Tab, 19 Ref.

Descriptors: *Chlorination, *Viruses, *Disinfection, *Chlorine, Sodium chloride, Potassium compounds, Cesium, Water purification, Analytical techniques, Water treatment.

The effects of chlorine disinfection of water on coxsackieviruses B3 (CB3) and B5 (CB5) were evaluated by exposing virus preparations to chlorine solutions in a continuous flow apparatus. Virus inactivation by chlorine in dilute buffer at pH 6 was very similar for CB3 and CB5; the inactivation rate was about half that for poliovirus (Mahoney) under similar conditions. Purified CB3 aggregated in the acid range but not at pH 7 or above, while purified CB5 aggregated in all pH ranges. The log surviving infectivity was graphically plotted as a function of time and resulted in a straight line. Dispersed CB5 provided no chlorine inactivation data because the virus could only be dispersed by diethylaminoethyl dextran, which reacts with chlorine. The aggregation of CB5 or the rate of chlorine action on the viruses was unaffected by the addition of 0.1 M NaCl to the buffer at pH 6. At pH 10, NaCl increased the disinfection activity of OCl(-) by a factor of 20 for both viruses; the addition of cesium chloride had a similar but lesser effect. The addition of KCl had the most rapid inactivation effect of the reagents. The inactivation effects of OCl(-) at pH 10 were equal to those of HOCl at pH 6 in the presence of KCl. (Lisk-FRC)
W81-00216

DESTRATIFICATION OF RESERVOIRS-A DESIGN APPROACH FOR PERFORATED-PIPE COMPRESSED-AIR SYSTEMS,
Water Research Centre, Marlow (England). Medmenham Lab.
J. M. Davis.
Water Services, Vol 84, No 1014, p 497-498, 501-504, August, 1980. 9 Fig, 1 Tab, 9 Ref

Descriptors: *Reservoir storage, *Destratification, *Mixing, *Dissolved oxygen, Design, Aeration, Thermal stratification, Epilimnion, Hypolimnion, Water circulation, Thermocline, Bubbles, Water quality control, Water storage

Artificial mixing devices should prevent thermal stratification and increase dissolved oxygen levels throughout the water column. The perforated-pipe compressed air device is being increasingly used to improve reservoir oxygen content. A summary is presented of the Water Research Centre's experience with perforated pipe systems and useful information is offered to determine the length of perforated pipe and compressor size needed for a particular reservoir. In thermal stratification, the thermocline forms a barrier between the epilimnion and hypolimnion isolating the lower layers of the reservoir from the air at the surface. A typical perforated pipe system in the UK involves a 200-m long pipe closed at one end with small holes which is submerged into the reservoir. Compressed air is pumped through the pipe and the air bubbles released entrain water from the lower levels and carry it to the surface. To apply the mathematical data for the determination of piping needed for a particular reservoir, volume, temperature profile, energy requirements and pressure conditions must be known. Other considerations included are pipe selection, total air flow, anchor weights and costs for equipment and operation of the destratification system. (Geiger-FRC)
W81-00235

5G. Water Quality Control

METHOD OF EFFECTING FLOCCULATION,
Kewanee Industries, Inc., Bryn Mawr, PA. (Assignee).
H. A. Green, J. J. Merianos, and A. N. Petrocci.
U.S. Patent No 4,188,293, 3 p, 6 Ref; Official Gazette of the United States Patent Office, Vol 991, No 2, p 620-621, February 12, 1980.

Descriptors: *Patents, *Water treatment, Water quality control, *Flocculation, Surfactants, Emulsions, Chemical reactions, Industrial water.

Another use for the compounds of this invention, or mixtures of such compounds, is for flocculation in aqueous systems. As flocculants, they cause the sedimentation of some materials which might otherwise remain in aqueous suspension; or, at least, they increase the rate of sedimentation in many cases where continued suspension of such immiscible materials cause a problem when it is desired to clarify and draw off the clear supernatant aqueous solutions or when it is desired to filter or drain suspensions in industries that require large volumes of water. The compounds also may be used to clarify waters in which the pollutants are emulsified. In such cases, the compounds may cause the emulsion to break. (Sinha-OEIS)
W81-00123

ROTARY FILTER APPARATUS,
T. Hagihara.
U.S. Patent No 4,188,294, 11 p, 24 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 991, No 2, p 621, February 12, 1980.

Descriptors: *Patents, *Water quality control, *Water pollution treatment, Filtration, Filters, Equipment, Channels, Running water.

A rotary filter apparatus is installed in a water channel in order to arrest, transport and dump the solids in the water currents while reconditioning the filter meshes for continuous operation. The apparatus includes an endless belt composed of many linking rods, linking plates, wire ropes or screen plates, and specially-shaped filter plates rockably fitted on the linking rods. The filter belt travels through the frame that can differentiate the track from the track of the filter plates. (Sinha-OEIS)
W81-00124

METHOD OF CONCENTRATING AND COLLECTING OIL SPILLS,
CIBA-GEIGY Corp., Ardsley, NY. (Assignee)
R. A Falk
U.S. Patent No 4,190,531, 9 p, 5 Tab, 3 Ref. Official Gazette of the United States Patent Office, Vol 991, No 4, p 1369, February 26, 1980.

Descriptors: *Patents, *Oil pollution, *Oil spills, *Water quality control, Oil-water interfaces, Films, Surface tension, Chemical reactions, Surface active agents, Fluorochemicals

Oil spills can be more effectively concentrated, collected, and controlled by employing a durable, rapidly spreading, water-insoluble surface film comprised of a fluorochemical. The fluorochemical agent has a density greater than water, a solubility of less than 0.01% in water, a spreading pressure, and is applied with a diluent to form a highly mobile film under actual field conditions Useful fluorochemicals are especially effective under adverse environmental conditions, and in combination with mechanical cleanup devices. (Sinha-OEIS)
W81-00131

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

EVALUATION OF STOCHASTIC STREAMFLOW MODELS FOR DETERMINATION OF MUNICIPAL WATER SUPPLY RELIABILITY,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering
J. R. Stedinger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112427, Price codes: A05 in paper copy, A01 in microfiche. Center for Environmental Research, Cornell Univ., Research Project Technical Completion Report September, 1980, 86 p. 7 Fig, 2 Append OWRT-A-085-NY (3), 14-34-0001-8034. 14-34-0001-0934.

Descriptors: *Synthetic hydrology, *Simulation analysis, Reliability, *Reservoir yield, Lognormal distribution, Correlations, Parameter uncertainty,

Upper Delaware River Basin, *Water supply, Municipal water.

This final report summarizes work performed to compare and evaluate the efficiency of alternative estimators of the parameters of 2- and 3-parameter lognormal distributions and the correlation among lognormal random variables. Also discussed is work performed on stochastic streamflow model verification and validation and the effects of parameter uncertainty on derived distributions. Appendices include the papers 'Synthetic Streamflow Generation, Part I: Model Verification and Validation' and 'Synthetic Streamflow Generation, Part II: Effect of Parameter Uncertainty', by J. R. Stedinger and M. R. Taylor.
W81-00012

THE APPLICATION OF PROJECT ANALYSIS TO NATURAL RESOURCE DECISIONS,
Minnesota Univ., St. Paul. Dept. of Agricultural and Applied Economics.
K. W. Easter, and J. J. Waelti.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112658, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, University of Minnesota, St. Paul, Bulletin Number 103, June 1980. 181 p. OWRT-A-999-MINN (50).

Descriptors: *Project planning, *Project analysis, *Project evaluation, *Cost-benefit analysis, Economics, Cost allocation, Irrigation, Navigation, Flood control, Recreation and environmental resources, Uncertainty, Externalities, *Water resources development.

This publication is intended to serve as a guide for the application of water project planning and analysis. Included are a perspective from which to review economic decisions; a brief history of evaluation procedures for U.S. water projects; a description of the Water Resources Council's procedures; the basic economics of project evaluation; problems in cost allocation; and individual applications to irrigation, flood control, navigation and related transportation, and recreation and environmental resources. Emphasis is placed on social benefits measured in terms of additions to real product and savings in terms of real resources.
W81-00023

HYDRAULIC DESIGN OF BRIDGES WITH RISK ANALYSIS,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 8A.
W81-00054

PLAN OF STUDY FOR THE NORTHERN ATLANTIC COASTAL PLAIN REGIONAL AQUIFER SYSTEM ANALYSIS,
Geological Survey, Trenton, NJ. Water Resources Div.
H. Meisler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-201023, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-16, April 1980. 27 p, 6 Fig, 1 Tab, 9 Ref.

Descriptors: *Aquifer management, *Project planning, *Regional analysis, *Atlantic Coastal Plain, *Aquifer characteristics, Groundwater, Pumping, Drawdown, Water levels, Geochemistry, Hydrogeology, Water supply, Forecasting, Model studies, Delaware, Maryland, New Jersey, New York, North Carolina, Virginia, Cones of depression.

Sediments of Cretaceous to Holocene age compose the Northern Atlantic Coastal Plain aquifer system in an area of 50,000 square miles in parts of New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina. The aquifer system is a major source of water supply in the area. About 1.4 billion gallons is withdrawn from its aquifers each day. Increasing withdrawal of ground water has created or intensified several problems such as declining water levels, development of large cones of depression, saltwater intrusion, spreading of ground-water contamination, and land subsidence. The U.S. Geological Survey has begun a comprehensive study that will define the geology, hydrology, and geochemistry of the aquifer system. The effects of future utilization of the aquifer system will be determined and alternative plans for water withdrawal will be evaluated through computer simulation modeling. This report describes the objectives, organization, and work plans of the study. (USGS)
W81-00068

DESIGN STUDY OF THE VTE BOILER CYCLE FOR THE DESALINATION OF SEA WATER VOLUME 1. MAIN REPORT AND APPENDIX A,
Envirogenics Systems Co., El Monte, CA.
For primary bibliographic entry see Field 3A.
W81-00071

TECHNOLOGY FORECASTING IN WATER RESOURCE PLANNING,
Iowa State Univ., Ames. Dept. of Industrial Engineering.
R. Viathionathan, R. Berger, and T. A. Austin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115669, Price codes: A07 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute, Iowa State University Completion Report, July 1980. 133 p, 14 Fig, 9 Tab, 55 Ref, 6 Append. OWRT-A-057-IA(2), 14-31-0001-5015.

Descriptors: *Forecasting, *Mathematical models, *Water distribution(Applied), *Technology, *Water resources planning, Methodology, Prediction, Future planning(Projects), Planning, Projections, Risks, Computer models, Iowa, Water resources, Irrigation, Consumptive use, Water resources development, Industry, Agriculture, Farming.

This report was a completion report for a three-year research project on technological forecasting methodologies in water resource planning, conducted in three phases: (1) investigation of various types of forecasting methodologies and development of an overall forecasting/planning system (containing exploratory and normative forecasting segments) applicable to water resource planning; (2) methodologies proposed in the exploratory segment were modified and tested in phases 2 and 3, and the Delphi technique was used to study the quantitative future of water withdrawal in the Iowa meat packing industry; and (3) several exploratory segment methodologies, integrated into a forecasting system, were used to forecast future irrigated acreage in six Western Iowa counties (Fremont, Harrison, Mills, Monoa, Pottawattamie, and Woodbury). Computer-based simulation of past data and subjective opinions of 'experts' were used to obtain scenarios of both the qualitative and quantitative future. The report concludes that there is a definite role to be played by technology forecasting. Conscientious and knowledgeable application of the described tools by water resource personnel can significantly aid the planning process. (Zielinski-IPA)
W81-00089

SYSTEMS ANALYSIS OF URBAN STORM WATER DETENTION BASINS,
Booker Associates, Inc., Lexington, KY.
D. K. Mynear, and C. T. Haan.
Transactions of the American Society of Agricultural Engineers, Vol 23, No 1, p 112-116 and 120, January-February 1980. 3 Fig, 3 Tab, 11 Ref. OWRT B-046-KY(6).

Descriptors: *Detention reservoirs, *Systems analysis, *Storm runoff, *Urban runoff, Structures, Hydraulic structures, Dams, Design, Planning, Model studies, Mathematical models, Drainage, Floods, Flood control, Design storm, Flood peak, Watersheds(Basins), Detention basins.

Urban storm water detention basins are generally designed without consideration being given to the overall effect and cost of several basins within a single watershed. By considering a system of basins, the total effectiveness of the basins can be increased while the costs are reduced. Computer programs and procedures are presented that make it possible to find a least cost system of detention basins that will control increased flows from urban areas to a predetermined level. (Sims-ISWS)
W81-00102

DEMAND-ELASTICITY-CONSERVATION RELATIONSHIPS,
M. B. Sonnen.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979. Franklin Pierce College, Rindge, NH, p 211-217, 1979. 3 Tab, 2 Ref.

Descriptors: *Land use, *Water conservation, *Mathematical models, Honolulu, Hawaii, Water demand, Numerical analysis, Probability, Equations, Hydrologic data, Agriculture, Political aspects, Land classification, Forecasting, Planning.

An algebraic analysis of the variables that affect water demands is used to show that water conservation may be a somewhat unsteady, infirm, incomplete, unstable cornerstone for our national water policy. A mathematical model designed to solve the monthly relationship between demand and supply for any particular land use category is described. The model can also describe this monthly relationship over a period of years. The complex expression illustrates that the factors of indoor conservation (CI) and outdoor conservation (CO) alone cannot be relied upon to slow the taking of water. The model equation can be differentiated for each independent variable to show which factors control either positive or negative demand. Also, the elasticity of demand factor can be derived for each variable. A calibration exercise was conducted for the Honolulu area where measured demand data were available. Elasticities of demand with respect to variables other than conservation percentage are calculated. The model shows that land use, although politically unpopular, is the most promising way to curtail water demand. Also, land use will be more effective than price increases or the installation of water saving devices. (See also W81-00160) (Seigler-IPA)
W81-00186

RISK MANAGEMENT IN WATER SUPPLY PLANNING,
Washington Suburban Sanitary Commission, Hyattsville, MD.
R. S. McGarry.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 228-244, 1979. 3 Fig, 5 Tab, 2 Ref.

Descriptors: *Washington(DC), *Cities, *Water policy, *Water supply, Task forces, Reservoirs, Potomac River, Droughts, Water shortage, Planning, Urbanization, Forecasting, Water demand, Federal Government, *District of Columbia Metropolitan Area.

The Bi-County Water Supply task force has made marked progress in solving the serious water supply shortage situation of the Washington, DC. metropolitan region. This process comes after 20 years of review and study with no action being taken. The Corps of Engineers, the Congress, and other Federal interests were not close enough or responsible enough to act on the community water supply problem. A citizen's advisory committee also played a major role. In October 1977 a thorough analysis of the supply and demand situation was accepted as showing a major problem in supply. The task force then had two management scenarios developed against which various supply alternatives were measured for feasibility and cost. Of 25 alternatives originally available, all but 7 were rejected for political or regional environmental reasons. The remaining 7 alternatives were for high flow skimming techniques, new storage reservoirs, or a groundwater possibility. The task force selected the alternative that caled for the utilization of a formerly planned Soil Conservation Service reservoir. Federal funding was abandoned and the reservoir will be locally financed. Land is

being acquired and the reservoir is being designed. The success of the task force illustrates that water supply planning is no longer an engineering problem, it has become a political, social, economic, environmental problem. (See also W81-00160) (Seigler-IPA)
W81-00188

6B. Evaluation Process

THE APPLICATION OF PROJECT ANALYSIS TO NATURAL RESOURCE DECISIONS,
Minnesota Univ., St. Paul. Dept. of Agricultural and Applied Economics.
For primary bibliographic entry see Field 6A.
W81-00023

ECONOMIC POTENTIALS FOR AGRICULTURAL WATER-SAVING USING ALTERNATIVE IRRIGATION TECHNIQUES,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 3F.
W81-00024

AN ECONOMIC EVALUATION OF GREENBELT IRRIGATION WITH EFFULENT WATER,
California Univ., Riverside. Dept. of Botany and Plant Sciences.
For primary bibliographic entry see Field 3C.
W81-00025

IMPACT OF ALTERNATIVE ENERGY PRICES, TENURE ARRANGEMENTS & IRRIGATION TECHNOLOGIES ON A TYPICAL TEXAS HIGH PLAINS FARM,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 3F.
W81-00032

FIVE YEAR RESEARCH PROGRAM 1982-1987: NEW HAMPSHIRE WATER RESOURCE RESEARCH CENTER,
New Hampshire Univ., Durham. Water Resource Research Center.
S. H. Higgens, R. R. Stever, and J. B. Hraba.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-111577, Price codes: A06 in paper copy, A01 in microfiche. Report submitted to Office of Water Research and Technology, October, 1980. 103 p, 11 Fig, 1 Map. 14-34-0001-0131.

Descriptors: *Research priorities, *Water resources, *Water resources institutes, Water Resources Research Act, Water policy, Water management, *New Hampshire, *State water problems, *State water needs, Institutional survey.

Pursuant to the Water Research and Development Act of 1978, a five-year research program was developed for the New Hampshire Water Resource Research Center. The study was submitted to the U.S. Department of the Interior, Office of Water Research and Technology (OWRT), for inclusion in a national plan. Water-related research needs were assessed through the Center's ongoing needs assessment process, augmented by an intensive survey of Federal, State, regional, local, and private institutions involved with water-resources in New Hampshire. The survey spanned a period of eight months, involving over 30 interviews and 35 responses from a mailed questionnaire. In addition, an exhaustive survey of the literature addressing water-resources management, planning and research in the State was undertaken. An analysis of the New Hampshire Water Resource (Section II), its uses (Section III), and the related management and planning mechanisms (Section IV), revealed a comprehensive list of water-related problems and research needs (Section V). Water-related problems and needs were grouped into six catagories: water quality, water supply, natural resources and ecology, energy development, recreation, and flood control. From this statewide tabulation, a subset of problems and needs were selected to be addressed in the Center's five-year research program (Section VI). The selection of research needs was based upon compatibility with the mission and goals of the Center, research capabilities at academic institutions in the State, other ongoing research efforts, and funding availability through the Center.
W81-00040

POTENTIAL USE OF THE TIEBOUT HYPOTHESIS IN WATER RESOURCE PROJECT EVALUATION,
Clemson Univ., SC. Water Resources Research Inst.
E. B. Sigmon, J. C. Hite, E. L. McLean, S. C. Lilley, and P. E. Lovingood, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113086, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No 86, May 1980. 107 p, 3 Fig, 31 Tab, 75 Ref, 2 Append. OWRT-A-040-SC(1), 14-34-0001-7086, 14-34-0001-8043, 14-34-0001-9043.

Descriptors: *Cost-benefit analysis, *Theoretical analysis, *Water resources, *Project post-evaluation, *Project planning, Model studies, Projects, Programs, Decision making, Project benefits, Project purposes, Environmental control, Econometrics, Welfare(Economics), Economies, Resources, Sulfur compounds, Air pollution, Computer models, Pollutants.

A major problem in water resource planning and project evaluation is lack of a common denominator for use in summarizing the various accounts, especially national economic development and environmental quality accounts, required by Principles and Standards promulgated in 1973. The Tiebout hypothesis, which relates an individuals' choice of residence with Quality of Life (QOL) factors, was extended empirically by evaluating tradeoffs between QOL factors to determine the practicability in using this as an approach to overcome the problem of incommensurates in water resource project evaluation. Application of this hypothesis to evaluation of water resource projects raised major econometric and data problems, and only limited success was achieved in this research. Practical data and measurement problems required that the analysis focus on ambient sulfur dioxide (SD) as the QOL factor under study. The computed exchange rates (between monetary income and ambient quality) ranged from $3 to $33/capita/ton SD/sq mi. While there was no formal test of these rates, they were evaluated relative to their usefulness and reasonability. Additional research was suggested for refining econometric tools and improving data accuracy, but it was tentatively concluded that the Tiebout hypothesis can provide a practical aide in project evaluation. (Zielinski-IPA)
W81-00073

DEVELOP WATER MANAGEMENT METHODS FOR WATERSHEDS SUBJECT TO INTENSIVE DEVELOPMENT,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
D. Davis, and H. B. Robotham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-114837, Price codes: A04 in paper copy, A01 in microfiche. Partial Project Completion Report, September, 1980. 58 p, 13 Fig, 13 Tab, 23 Ref, 1 Append. OWRT-A-069-ARIZ(3), 14-34-0001-6003.

Descriptors: *Water management(Applied), *Watershed management, *Algorithms, *Reservoir construction, Water resources, Economic evaluation, Water demand, *Arizona, Computer programs, Water supply development, Alternate water use, Area redevelopment, Water utilization, Estimating, *Sonorita Creek watershed(AZ).

This study, undertaken due to increased concern over the adequacy of the Sonorita Creek watershed in meeting future water demands in the Patagonia-Sonorita area in Arizona, investigated various water resources management alternatives for the watershed. While agricultural and recreational demands are expected to remain fairly constant, municipal and domestic demands are expected to triple over the next twenty years. Six potential water resources management alternatives were developed and compared using standardized cost-effectiveness methodology, allowing for intercomparisons of these alternatives with respect to quantifiable and inquantifiable criteria. Each alternative considered development of either ground-water or surface water resources of the watershed, as well as a method for disposal of treated sewage. Selection of a watershed plan was made using the ELECTRE I algorithm, due to its established utility in multiobjective decision problem analysis. Based on use of available ground and surface water resource information for the watershed with this approach, the most optimum alternative specified construction of a small reservoir at Redrock Canyon having evaporation control measures as a supplemental water source for Patagonia, Arizona, and for the Sonorita Creek Sanctuary. (Zielinski-IPA)
W81-00074

CHARACTERIZATION AND LAND APPLICATION OF SEAFOOD INDUSTRY WASTEWATERS,
North Carolina State Univ. at Raleigh. School of Agricultural and Life Sciences.
M. R. Overcash, and D. Pal.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-114654, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina. Report No 142, August 1980. 33 p, 7 Fig, 9 Tab, 16 Ref. OWRT-B-100-NC(10), 14-34-0001-7173.

Descriptors: *Industrial wastes, *Commercial fishing, *Seafood industry, *Waste assimilative capacity, Methodology, Nutrients, Wastes, Waste identification, *Land management, Sites, Soil types, Clay loam, Sandy loam, Shrimp, Crab, Tuna, Oyster.

Soil-plant systems are capable of utilizing seafood industry waste water with little or no pretreatment requirements. Raw waste from seafood processing plants contain substantial plant nutrients including nitrogen, phosphorus and calcium. In calculating a capacity for soil-plant assimilation of waste effluents, land areas necessary for the environmental compatible operation of a treatment site were estimated. Four segments of the seafood processing industry: (shrimp, crab, tuna and oyster) were selected for land treatment evaluation. Bulk volume and composition of waste were characterized for average size plants. One objective was to further demonstrate the utility of a recently developed complete design procedure for land treatment of the entire waste stream from any given industry Two common soil characteristics were focused on as representing significantly different soil textures: (1) a sandy loam, and (2) a clay loam soil. When compared to a sandy loam site, a clay loam site reduced the land needs for shrimp and crab processing. It had no effect on tuna wastes. Oyster land areas were increased in going to a clay loam site. It is generally recommended that a detailed design is needed prior to land treatment because of probable variations in site and waste characteristics. (Stiles-IPA)
W81-00079

A LINEAR PROGRAMMING MODEL OF AGRICULTURAL ACTIVITY AND RESOURCE USE UNDER CHANGING RESOURCE CONDITIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences
For primary bibliographic entry see Field 3F.
W81-00083

ANALYSIS BARRIERS TO IMPROVING THE HYDROELECTRIC POWER INTERFACE WITH ELECTRIC POWER SYSTEMS,
Camp Dresser and McKee, Inc., Waltham, MA
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-117244, Price codes: A05 in paper copy, A01 in microfiche. Final Report prepared for the Office of Water

Research and Technology, September 30, 1980. 87 p. OWRT-C-90237-T(no 9625)(1), 14-34-0001-9625.

Descriptors: *Hydroelectric power, *Electric power production, *Electric power industry, Analysis, Reservoir storage, Pumped storage, Utilities, Constraints, Optimization, *Hydro/thermal scheduling, Load management, Economic dispatch, Demand forecasting, Unit commitment, Public Utilities Regulatory Policy Act of 1978, Analysis barriers.

The analysis barriers to improving the interface of hydroelectric power with electric power systems are investigated and discussed. The value of hydropower to society and the utilities is explored touching on the problems of weather and hydrological dependencies, multiple-use conflicts and engineering aspects. Special attention is afforded to the organizational structure of the electric utility industry and the operational and planning functions as they relate to hydroelectric power production. Analytical approaches taken to optimize the use of hydropower over time are surveyed. Current barriers to these approaches are presented along with future research topics which potentially may alleviate them.
W81-00121

PREDICTING WATER USE CONSIDERING CONSERVATION,
Johns Hopkins Univ., Baltimore, MD.
J. J. Boland, and P. H. Carver.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 88-93, 1979. 1 Tab, 8 Ref.

Descriptors: *Water conservation, *Water utilization, *Mathematical models, *Forecasting, Estimating, Water supply, Measurement, Water demand, Planning, Equations, Water users, Water rates, Water allocation, Disaggregate demand forecasts.

An expression for the prediction of the effectiveness of water conservation measures is discussed and defined as the quantity of water per unit time which is expected to be saved through implementation of a measure. Conservation measures are classified by the user class affected and by the time of implementation. In general quantitative estimates are deficient because they are 'a priori' engineering estimates, are based on casual empiricism, or are stated in terms of water use at an inappropriate level of aggregation. Water conservation measures may be classified as behavioral modification such as improved use practices, leak repair, economic incentives, and water use regulation or as technological change such as water-saving toilets, faucet aerators, and the substitution of other inputs. A two step procedure is needed for forecasting. First unrestricted water use must be estimated then the aggregate effectiveness of the conservation measures can be determined and deducted to yield a future forecast. General conclusions concerning forecasting are that water conservation measures must be explicitly considered in forecasting future water use, a disaggregate demand approach should be used instead of the widely-used per capita requirement approach, and more data and research are needed on disaggregate demand forecasts and on actual applications of conservation measures. (See also W81-00160) (Seigler-IPA)
W81-00170

TECHNOLOGY ASSESSMENT FOR WATER RESOURCE MANAGEMENT IN URBANIZING AREAS,
Gates (W.E.) and Associates, Inc., Fairfax, VA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119570, Price codes: A04 in paper copy, A01 in microfiche. Completion Report presented to Office of Water Research and Technology, September, 1980. 69 p, 4 Fig, 335 Ref. OWRT-C-90226-T (No 9626)(1).

Descriptors: *Water resources, Mathematical models, *Urbanization, *Evaluation, *Hydrology, *Water supply, *Water sources, *Recreation, *Institutions, Technology, Methodology, Research and development, Planning, Water resources development, Mathematical studies, City planning, Urban hydrology, Urban sociology, Suburban areas, Statistics, Statistical methods.

This technology assessment focused on an evaluation of existing technologies for water resource management in urbanizing areas and the development of recommendations for research priorities that would enhance the technologies. The water resource management elements studied were hydrology, water supply, nonpoint sources, recreation, and institutions. Two distinct approaches to water resource management in urbanizing areas were considered: (1) the economic (demand) approach (required carrying capacity supplied by a combination of resident capacity and capacity derived through various service delivery systems); and (2) the ecologic (control) approach (carrying capacity fixed at a prescribed level). The existing technologies were viewed within four states of understanding: phenomenological, empirical, statistical, and deterministic. Recommendations for the five management elements were formulated. These were for research on application of spatial processes suggested in the Hewlett phenomenological model (hydrology); on conceptualization of a watershed as a reactor and its characterization (nonpoint sources); on phenomenological model development (recreation); on implications of removing institutional constraints on implementing technologies (water supply); and on the timing and geographic extent of water resource management institutions (institutions). (Zielinski-IPA)
W81-00190

AN ASSESSMENT OF NONPOINT SOURCE TECHNOLOGY FOR WATER RESOURCE MANAGEMENT IN URBANIZING AREAS,
Gates (W.E.) and Associates, Inc., Batavia, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118788, Price codes: A04 in paper copy, A01 in microfiche. Completion Report prepared for Office of Water Research and Technology, September, 1980. 68 p, 1 Fig, 1 Tab, 41 Ref, 1 Append. OWRT-C-90226-T(No 9626)(1).

Descriptors: *Water resources, *Mathematical models, *Urbanization, *Evaluation, *Water sources, Hydrology, Water supply, Recreation, Institutions, Technology, Methodology, Research and development, Planning, Water resources development, Mathematical studies, City planning, Urban hydrology, Urban sociology, Suburban areas, Statistics, Statistical methods.

Fourteen comprehensive models of the nonpoint source process were reviewed, and their space-time characteristics and component processes described (Appendix:31 p, 8 tab, 11 fig). With only one exception, comprehensive model components were empirical or deterministic, with the current trend being the use of deterministic relationships. This exception, the ADAPT statistical NPS model, should have resulted in more operational models in light of the large field data sets (urban and rural) collected over the past decade. The empirical-deterministic component formulations were all generally derived from a few basic models. Also, there appeared to be a trend towards greater incorporation of spatial characteristics in more recent models. Historically, nonpoint source research has been segregated into three areas: urban analysis, sediment modeling, and chemical modeling. A minimal level of evolutionary conceptual research has occurred relative to the work spent on aggregting modules within these three areas into a comprehensive model, and emphasis more on mathematical models than on conceptual understanding has led to significant problems greatly affecting the capacity to model nonpoint sources. The primary research requirement is to establish a common framework in which nonpoint source research and modeling may be placed. A proposed watershed reactor concept provides such a general framework. (Zielinski-IPA)
W81-00191

TECHNOLOGY ASSESSMENT OF HYDROLOGY FOR WATER RESOURCE MANAGEMENT IN URBANIZING AREAS,
Gates (W. E.) and Associates, Inc., Batavia, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118754, Price codes: A05 in paper copy, A01 in microfiche. Completion Repot prepared for Office of Water Research and Technology, September, 1980. 11 p, 1 Fig, 32 Ref, 1 Append. OWRT-C-90226-T(No 9626)(1).

Descriptors: *Urban hydrology, *Water resources, Rainfall-runoff relationships, *Mathematical models, Urbanization, Evaluation, Surface-groundwater relationships, Water supply, Water sources, Recreation, Institutions, Technology, Methodology, Planning, Water resources development, Mathematical studies, City planning, Hydrology, Statistics, Suburban areas, Research and Development.

The historical development of rainfall-runoff models is discussed (Appendix: 33 p, 24 fig, 78 ref.) with emphasis placed on the evolution of the models and their responsiveness to the changing spatial requirements in rainfall-runoff and nonpoint source modeling. Primary emphasis in hydrologic analysis has been rainfall-runoff modeling; the prediction of how a watershed/catchment transforms rainfall into stream flow. Model development occurs through an iterative process involving phenomenological, statistical-empirical, and deterministic model forms. Rainfall-runoff modelling is currently in a stage in the iterative development process between two phenomenological models. All operational rainfall-runoff models are largely based on the outdated Horton model, while broad-based general acceptance has occurred for the spatially-based Hewlett model. It would appear that the major need today in rainfall-runoff modelling is in research to understand and formalize the spatial processes suggested in the Hewlett model. A requisite to construction of a complete phenomenologic model are data on the actual spatial/temporal path followed by water under a wide range of physiographic conditions. Field work using tracers was suggested as one means of developing such data. (Zielinski-IPA)
W81-00192

LITERATURE REVIEW FOR WATER SUPPLY FOR URBANIZING AREAS,
Howard (Charles and Associates Ltd., Vancouver (British Columbia).
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119547, Price codes: A03 in paper copy, A01 in microfiche. W. E. Gates and Associates, Inc., Fairfax, VA. Completion Report prepared for Office of Water Research and Technology, September, 1980. 25 p, 6 Fig, 2 Tab, 115 Ref. OWRT-C-90226-T(No 9626)(1).

Descriptors: *Publications, *Reviews, *Water supply, *Urbanization, *Statistical methods, Water resources, Evaluation, Hydrology, Urban hydrology, Water sources, Recreation, Institutions, Technology, Methodology, Research and Development, Planning, Water resources development, Mathematical studies, City planning, Suburban areas, Statistics.

This study involved the development of recommended strategies for future research investment in water sources for urbanizing areas, providing background information related to water supply, treatment, and distribution. To quantify the recommendations, the most recent literature in the field was summarized, classified, and analyzed to identify past research trends. The review was confined to articles published within the last two years, covering 450 articles for analysis by multiple classification systems and a statistical approach. Fifty-one of these, published between 1978-1980 dealt with some type of problem associated to water resources for urbanizing areas; the remainder dealt primarily with industry or pure hydrology related problems. Information extracted from the 51 articles were classified using four independent schemes: primary subject matter, level of specificity, level of sophistication, and author's research approach. Each article was read and classified in all four schemes. Most research was found in the water treatment field, compared to water supply quantity aspects. The literature indicated that im-

plementation of existing technology, especially during draught periods, represented troubled areas. (Zielinski-IPA)
W81-00193

TECHNOLOGY ASSESSMENT AND RESEARCH NEEDS OF WATER-BASED RECREATION FOR URBANIZING AREAS,
Wright-McLaughlin Engineers, Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118812, Price codes: A07 in paper copy, A01 in microfiche. W. E. Gates and Associates, Inc., Fairfax, VA. Completion Report prepared for Office of Water Research and Technology, September, 1980. 141 p, 22 Fig, 1 Tab, 49 Ref, 1 Append. OWRT-C-90226-T(No 9626)(1).

Descriptors: *Recreation, *Water supply, *Urbanization, *Water sports, *Research priorities, *Land use, *Statistical methods, Water resources, Evaluation, Hydrology, Water sources, Institutions, Technology, Methodology, Research and Development, Planning, Water resources development, City planning, Urban hydrology, Suburban areas, Statistics.

The recreation planning process was studied with special emphasis on its application to urbanizing areas and on water-based recreation. Available technologies were examined as to how each fits within the planning process. A description of the methodology of each with examination of its level of sophistication was carried out (phenomenological-empirical-stochastic-deterministic), and critiqued to identify potential research areas. Nine suggested research areas were prioritized by evaluation of the probable value derived from research expenditures. The highest priority was general research for a coordinated comprehensive approach to general land use planning for urbanizing areas, prior to the undertaking of more detailed research into specific areas. Other suggested priorities included a substantial improvement in economic variation of the whole planning process for urbanizing areas, and improvement in application of the survey method to improve the definition of desires and needs of a future population. A comprehensive bibliography on recreation planning (325 references) is given in the appendix. (Zielinski-IPA)
W81-00194

EXISTING BASE AND RELEVANT PRACTICES -- INSTITUTIONAL ARRANGEMENTS FOR WATER RESOURCE MANAGEMENT IN URBANIZING AREAS,
Robinson, Farmer, Cox Associates, Richmond, VA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119562, Price codes: A03 in paper copy, A01 in microfiche. W. E. Gates and Associates, Inc., Fairfax, VA. Completion Report prepared for Office of Water Research and Technology, September, 1980. 45 p, 3 Tab. OWRT-C-90226-T(No 9626)(1).

Descriptors: *Institutions, *Urbanization, *Water resources, *City planning, *Water supply, *Evaluation, Hydrology, Water sources, Technology, Methodology, Research and Development, Planning, Water resources development, Statistical methods, Urban sociology, Suburban areas, Water management.

Specific problems seen in other areas of the study (water supply, drainage, nonpoint source pollution and water-based recreation) were seen as being able to be remedied by improving the powers, geographical jurisdiction, and timing of institutions intended to manage a water resource. It was concluded that there is political support for their exercise. Research concluded as being helpful to these areas was identified in a list of twelve program reseach elements. These research elements included: investigating the divergence in popular opinion that regional water resources agencies are better, yet such institutions are rarely found; determining how institutions can be organized and established sufficiently early in the urbanization process for design and construction of institutions in an urbanizing area; devising state or other supralocal strategy for establishing timely, effective, and appropriate local institutions for water resource management in urbanizing areas; and describing the impact of water resources on the real estate market during the urbanization process. (Zielinski-IPA)
W81-00195

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

WATER DISTRICT REVENUE IMPLICATION OF CONSERVATION,
East Bay Municipal Utility District, Oakland, CA.
D. G. Larkin, and K. E. Carns.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 204-210, 1979. 1 Tab

Descriptors: *California, *Water conservation, *Water rates, *Economic impact, Prices, Water utilization, Utilities, Water works, Droughts, Water shortage, Costs, Income, Planning, Profit, Economic prediction

Water conservation is the single most important factor which has triggered revenue problems for the East Bay Municipal Utility District in Oakland, California. Following the 1976-1977 drought, water consumption levels have not returned to predrought levels and are now at about 83% of the normal pre-drought level. Consumption is expected to rise only to 90% of normal in the early 1980's despite increasing numbers of customers. Customers' water bills have increased from the predrought level of $4.70/month to the current $7.00/month to help offset the financial losses due to conservation. An even greater increase has occurred in industrial and commercial bills. Revenue problems caused by conservation have been further heightened by inflation, Proposition 13, delayed rate increases, and the development of new water risk schedules. Innovative utility financial policies will be needed to meet the increasingly unpredictable future. Conservation must be considered in planning and more frequent reviews of water rates will have to be conducted. (See also W81-00160) (Seigler-IPA)
W81-00185

6D. Water Demand

STATE INVOLVEMENT IN WATER DEVELOPMENT OF SMALL AREAS,
Tennessee Univ., Knoxville.
S. P. Coelen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-110751, Price codes: A05 in paper copy, A01 in microfiche. Institute for Research on Land and Water Resources, The Pennsylvania State University, University Park, Research Project Technical Completion Report, Sept. 1980, 92 p, 5 Fig, 8 Tab, 14 Ref. OWRT A-037-PA(1), 14-34-0001-9040.

Descriptors: *Water resources development, *Rural areas, *Analysis, *Pennsylvania, *Water supply development, Water utilization, Sewerage, State involvement, Evaluation, Rural water problems, Water firms, Capital subsidies, State financing, Sanitarians.

An institutional and theoretical analysis is presented of the role that states should play in providing water to rural areas. The research question addressed is: If private suppliers are to continue providing water in rural areas, is a subsidy system necessary or desirable. The initial conception of this question was made by the Water Supply Task Force Committee (WSTFC) of the state of Pennsylvania. In response to the research needs stated by WSTFC, the analysis done here is predominantly economic in perspective. Several social, political, and engineering aspects of the problem are left unaddressed. The analysis is conducted in two parts: (1) an evaluation of the historical record of state involvement in rural water problems, surveying all the states to assess their comparative record of involvement; and (2) an analysis of both the theoretical values and appropriate limitations of state involvement.
W81-00015

ANALYSIS BARRIERS TO IMPROVING THE HYDROELECTRIC POWER INTERFACE WITH ELECTRIC POWER SYSTEMS,
Camp Dresser and McKee, Inc., Waltham, MA.
For primary bibliographic entry see Field 6B
W81-00121

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN FOR THE STATE OF MONTANA,
Montana State Univ., Bozeman. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119596, Price codes: A04 in paper copy, A01 in microfiche Report submitted to the Office of Water Research and Technology, October, 1980. 47 p, 1 Fig, 2 Tab, 28 Ref, 8 Append. 14-31-0001-0128.

Descriptors: *Research priorities, *Montana, *Research and Development, *Planning, *Water resources, Institutions, Local governments, Federal government, Operations, Project planning, Water resources development, Water supply, Water sources, Potential water supply, Scheduling, Programs, Forecasting, Reservoirs, Water consumption, Agricultural watersheds, Irrigation.

The report, developed to meet requirements of the Water Research and Development Act of 1978, documented Montana water resources and related land-use problems, and presented a prioritized research agenda to improve a comprehensive planning/management program to meet Montana's water resources needs. Agriculture is the major water consumer, accounting for 95 percent of the water used in the State. Reservoirs provide about 28 million acre-feet of live storage in order to maintain streamflow through the summer in major streams, yet major problems occur in provision of water qualities needed during low flow periods in needed locations. Sufficient unappropriated water is available for increased uses at present and for demands projected through the year 2020. The major water-related problems lay in providing water in locations where it is needed when it is needed. The five-year program recommends that funding of the Water Center research projects be encouraged in support of agencies engaged in studies most critical to State, regional, and national water problems. The most significant water quality problems identified were from sediments and salts from nonpoint pollution sources, and from reduced streamflows due to withdrawals. (Zielinski-IPA)
W81-00196

6E. Water Law and Institutions

INCENTIVES FOR AGRICULTURAL WATER CONSERVATION,
Sonnen (M. B.) Co., Inc., Walnut Creek, CA
For primary bibliographic entry see Field 3F
W81-00003

THE POLITICAL FEASIBILITY OF ALTERNATIVE STRATEGIES FOR MANAGING WATER DEMAND IN SOUTHERN ARIZONA,
Arizona Univ., Tucson. Dept. of Political Science
J. R. McCain.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-109803, Price codes: A04 in paper copy, A01 in microfiche Project Completion Report, September 15, 1980. 45 p. OWRT A-085-ARIZ(2), 14-34-0001-8003.

Descriptors: *Political aspects, *Water law, *Water demand, Pricing, Planning, *Water resources development, *Arizona, Water management problems, Decision making, Water policy.

Decision-makers are restricted in their choice of alternative policies by physical, economic, attitudinal and legal/institutional constraints, all of which may or may not be operative in any particu-

lar situation. This report examines the interrelationships between attitudinal and legal constraints in the context of policies for the local development, use and management of water resources in Tucson, Arizona. The attitudinal constraints are identified as those images or beliefs which compose the 'water-is-different' syndrome--specifically the 'free-good,' 'desert,' and 'survival' images of water. The legal/institutional constraints are discussed in terms of water laws--both statutory and common. The effect of these constraints on water policy, in Tucson and elsewhere, has been to emphasize supply solutions to water management problems. Demand management strategies have traditionally been avoided in water policymaking. In 1976, however, public officials in Tucson did develop and implement policies aimed at reducing demand for water. Although these demand management policies appear to have been ultimately successful, the changes did not come without costs. The innovative actions of these public officials precipitated a political crisis in which they were actually turned out of office. Ironically, this crisis may have also had the unexpected effect of institutionalizing a demand management system in Tucson.
W81-00007

SOME IMPLICATIONS OF WATER LAW AND RIGHTS TOWARDS LAND USE PLANNING: VERMONT CASE STUDIES,
Vermont Univ., Burlington.
P. J. Folkman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-111270, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis, 1980. 86 p, 4 Fig, 2 Tab, 128 Ref. OWRT-A-035-VT (1), 14-34-001-9048.

Descriptors: *Water law, *Water resources planning, *Land use, *Riparian land, Watercourses(Legal aspects), Common law, Water pollution control, Surface water availability, Groundwater availability, Vermont water law, Winooski River(VT).

A theory that water law and rights have an effect on land use planning and therefore should be included as a component in the land use planning process is proposed. Research presented summarizes Vermont's common, statutory, and administrative water laws and rights. Three Vermont case studies are examined which substantiate the proposed theory. The case study examples include a diversity of water resources and laws such as: running waters (rivers) and administrative law; standing surface water (lake) and administrative and statutory law; and ground water and the common law. The case studies identify some implications these various water laws have on the land use planning process. The primary conclusion is that a review of water laws and rights should occur at the data collection stage in the land use planning process to preclude land use planning and water law conflicts.
W81-00010

LEGAL AND PROCEDURAL PROBLEMS OF THE ADMINISTRATION AND ENFORCEMENT OF WATER RESOURCES LAWS AND REGULATIONS,
West Virginia Univ., Morgantown. Water Research Inst.
V. P. Cardi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-110744, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, 1980. 33 p. OWRT-A-027-WVA (1), 14-31-0001-5059.

Descriptors: Administrative decisions, Judicial decisions, Law enforcement, *Legal aspects, Regulation, *West Virginia, *Water law, *Water pollution, Adjudication procedure, Administrative agencies, Decision making, Local governments, Legislation, Management, Penalties(Legal), Political aspects, Sewage districts, Water policy, Water users.

The purpose of the study was to investigate and determine what problems exist in the administration of West Virginia water laws and regulations as perceived by those involved as consumers of water resources and by those involved in the processes of delivering and regulating water services. Conclusions reached are that many persons having water-resource problems feel they receive inadequate assistance from available attorneys, building and road contractors do not feel hampered by problems in water law, diversion of surface (sheet) runoff in residential areas is not handled adequately by the 'common law' or 'common enemy' rule, normal difficulty in attaching responsibility for water and siltation damage caused by major construction performed by a private party or by the state is made much more difficult if both the state as owner and a private party as contractor are involved, law guiding the right of local sanitary districts to deny service to new customers and to terminate existing but unauthorized customer use is uncertain and confusing, and the statutory scheme of the Water Resources Board and the form and procedure of its practice are in need of change that should include movement toward a full-time professional board and other major changes.
W81-00014

FIVE YEAR RESEARCH PROGRAM 1982-1987: NEW HAMPSHIRE WATER RESOURCE RESEARCH CENTER,
New Hampshire Univ., Durham. Water Resource Research Center.
For primary bibliographic entry see Field 6B.
W81-00040

WATER SHORTAGES IN THE SOUTHEAST,
North Carolina Water Resources Research Inst., Raleigh.
D. H. Howells.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, Franklin Pierce College, Rindge, NH, p 147-155, 1979. 2 Ref. OWRT-B-123-NC-(8)-B-125-NC-(7).

Descriptors: *Water conservation, *Water shortage, *Southeast U. S., Humid areas, Wet climates, Water allocation(Policy), Equitable apportionment, Riparian rights, Water law, Water sources, Planning, Saline water intrusion, Urbanization, Recharge, Groundwater.

Although the Southeast is in general a humid region with abundant precipitation, perennial water shortages are of increasing concern. These shortages are caused by disparities between timing and location of supply and demand and individual system deficiencies. These problems are expected to increase due to population growth, industrial production, and agricultural irrigation. Some States in the area are considering switching from the riparian to the prior appropriation doctrine as a means of water allocation. Legislation in Mississippi, North Carolina, South Carolina, and Virginia has made provisions for the allocation of groundwater. Florida has taken the most far-reaching allocation steps with administrative regulation of surface and groundwater withdrawals. To ultimately balance water supplies and demand, transriparian and interbasin transfer will be needed. More study is needed in areas such as minimum streamflows, drought and emergency allocations, preservation of needed reservoir sites, protection of groundwater recharge areas, saline water intrusion, and other pollution and protection concerns. New mechanisms for interstate cooperation during times of water shortage are also needed. A comprehensive system involving State and regional water resources planning and management is needed to provide an overview and areawide perspective of how to best use available water supplies. (See also W81-00160) (Seigler-IPA)
W81-00178

DROUGHT EFFECTS ON METROPOLITAN WASHINGTON, D.C. AREA,
Corps of Engineers, Baltimore, MD.
J. E. Crews, and W. E. Trieschman.
In: Proceedings of the Conference on Water Conservation Needs and Implementing Strategies, July 9-13, 1979, Franklin Pierce College, Rindge, NH, p 156-164, 1979. 2 Fig, 1 Tab, 12 Ref.

Descriptors: *Washington(DC), *Water allocation(Policy), *Potomac River, Droughts, Low flow, Water shortage, Urbanization, Virginia, River flow, Water conservation, Planning, Water supply, Utilities, Water works, Suburban areas.

The Metropolitan Washington Area (MWA) depends on the Potomac River for most of its water supply. The river is unregulated and flows fluctuate widely with an average of 6,000 million gallons per day. This average is more than enough to meet current and future demands, however, during periods of drought this average drops sharply and steps are being taken to assure equitable allocation during such times. In the 1970's, two adjoining areas were given permission to tap the Potomac, the Washington Suburban Sanitary Commission (WSSC) and the Fairfax County Water Authority (FCWA). Recognizing that a critical situation could develop during times of low-flow, the utilities for MWA, WSSC, and FCWA signed a Low Flow Allocation Agreement in January 1978. Under the agreement all utilities could share the available water according to a predetermined formula. This agreement provides for fair allocation of existing water but it will not eliminate shortages. Each of the utilities has therefore set up water shortage emergency plans. Also, the Corps of Engineers is conducting a water supply study for the most efficient use of existing supplies before new water sources are developed. Four plans have been formulated for the future, all of which include a water conservation program. (See also W81-00160) (Seigler-IPA)
W81-00179

MEDITERRANEAN STATES AGREE ON TREATY TO CONTROL LAND-BASED POLLUTION,
I. Guest.
Ambio, Vol 9, No 3-4, p 194-195, 1980.

Descriptors: *Mediterranean Sea, *Water pollution sources, *Water pollution control, *International commissions, Regulation, Water pollution, Rivers, DDT, Pesticides, Heavy metals, Industrial wastes, Sewage, Toxins, Costs, Legislation, Oceans.

A treaty was proposed by fifteen of the states bordering the Mediterranean Sea and by the European Economic Community to control land-based sources of pollution in the sea. It is estimated that 85% of the pollution in the Mediterranean Sea comes from the land, most of it carried by rivers. An estimated 90 tons of DDT and other pesticides flow into the sea yearly, as well as tons of heavy metals, industrial wastes, and untreated sewage. Cleaning up the sea will cost $10-15 yr. The agreement established a list of toxic substances so dangerous that their emissions are banned altogether (e.g. mercury, cadmium, radioactive substances and lubricating oils) and a list of 20 substances which will be allowed in strictly controlled quantities (e.g. lead, silver, tin). Limits of tolerance must be established by the cooperating states. Now that the various governments have recognized their common problem, the scientific community will have to resolve differences of opinion as to what constitutes pollution. Problems remaining include argument over the site of the program secretariat and enforcement of the agreement. (Baker-FRC)
W81-00213

THE INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE PREPARES FOR LAUNCHING,
World Health Organization, Geneva (Switzerland). Div. of Environmental Health.
G. Schultzberg.
Ambio, Vol 9, No 3-4, p 201-202, 1980. 1 Fig.

Descriptors: *Potable water, *United Nations, *Water resources development, *Public health, Water supply, Environmental sanitation, International commissions, Attitudes, Administrative agencies, Projects, Programs.

Plans are discussed for the International Drinking Water Supply and Sanitation Decade (beginning

November 1980) supported by the Economic and Social Council of the United Nations. The goal of the program is to adopt programs with realistic standards of quality and quantity of water supplies for both rural and urban areas of the world by 1990. A rapid assessment exercise by Member States revealed that few countries have taken steps to put the goal into action. However, the fact that over 100 countries are participating in the assessment phase is seen as encouraging. Completion of the goal may be slowed by a lack of manpower to prepare plans and programs. The success of the Decade will depend on the initiative of each country and its willingness to act. Changes will be needed both in attitudes and in approaches to sanitation and health care in developing countries and among multilateral and bilateral agencies involved. (Baker-FRC)
W81-00214

WATER POLLUTION ABATEMENT PROBLEMS AROUND LIVESTOCK,
Nebraska Univ.,-Lincoln.
C. B. Gilberston.
Agricultural Engineering, Vol 61, No 8, p 24-25, August, 1980. 1 Fig.

Descriptors: *Agricultural runoff, *Water pollution control, *Feed lots, *Permits, *Administrative agencies, Legislation, Environmental Protection Agency, Fishkill, Water pollution, Farm wastes, Regulation, Clean Water Act, Drainage water, Environmental sanitation, State jurisdiction.

Government regulations concerning feed-lot pollution are discussed. Feed lots were identified as sources of water pollution in the 1960s, when fishkills were thought to be due to uncontrolled runoff. Water pollution control laws banning discharge of feed-lot runoff into public streams, lakes or ponds were passed in several states in the 1970s. It was planned at that time that by 1983 all public waters would be safe for fishing, boating and swimming. Permits issued by EPA through the National Pollutant Discharge Elimination System (NPDES) are required for specific capacity feed lots, for situations in which a stream runs through a 300-1,000 head lot, or for any operation which significantly pollutes a body of water. Permit requests are made to a State Water Control Agency or the EPA, after which a preliminary permit is made available for review by the livestock operator, the interested state agency, and the public. Permits are valid for 5 yr. Effluent limits stated in the permit are site-specific and comply with NPDES guidelines. Effluent guidelines have, however, been difficult to interpret. Specific management techniques which help reduce pollution include better shaping of feed lots to improve drainage, maintenance of watering equipment, and good sanitation practices. (Baker-FRC)
W81-00229

WATER, WATER EVERYWHERE, BUT LESS OF IT TO DRINK,
K. J. /Scott
Ambio, Vol 9, No 3-4, p 200-201, 1980.

Descriptors: *Clean Water Act, *Potable water, *Water purification, *Industrial water, *Municipal water, Legislation, Water quality, Industrial wastes, Costs, Industrial plants, Water pollution, Public health, Toxins, Water pollution control.

The article briefly reviews the problems encountered over the past several years in efforts to maintain satisfactory quality control for drinking water supplies in the United States. Cost is one of the major factors which makes the program difficult to accomplish. In view of deteriorating quality of water supplies, the Congress passed the Clean Water Act in 1972. This required industrial plants to obtain discharge permits, and provided federal aid for the construction of municipal sewage treatment plants. 1985 was set as the target date by which industrial users were to return water to the source as clean as it was when they removed it. Progress in following the requirements of this act has been mixed. Not only are there problems in the original pollution to be removed, there are now problems created by the by-products of water purification programs. Each new crisis has lead to the restructuring of rules to meet it. However, with each new regulation imposed, arguments are presented by companies complaining that compliance would drive them out of business, or by municipalities claiming that some of these precautions are not necessary for them. (Baker-FRC)
W81-00246

6G. Ecologic Impact Of Water Development

GUIDELINES FOR INTEGRATING GEOLOGICAL AND ARCHAEOLOGICAL INFORMATION INTO WATER RESOURCE PROJECT ENVIRONMENTAL ANALYSIS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
M. Bradley, and D. A. Altshul.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-114019, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, September 1980. 37 p, 13 Ref, 3 Append. OWRT-A-088-ARIZ (2), 14-34-001-8003, 14-34-001-9003.

Descriptors: *Water resources development, *Legal aspects, *Geology, *Archaeology, *Standards, Water resources, Environmental effects, Environmental control, Legislation, Wild River Act, Documentation, Information exchange, Reviews, National Historic sites, State governments, State jurisdiction.

The purpose of this paper was to introduce techniques and develop guidelines for use by public officials conducting interdisciplinary environmental studies, and for integrating this data into environmental impact reports. The general guidelines developed serve as the method for project planners/administrators in conducting cultural resource analysis on Federally funded water projects. The guidelines follow three steps: (1) initial contact with the appropriate State Historic Preservation Officer (SHPO); (2) review of detailed information from private consultants and the SHPO and development and incorporation of recommendations into the text of a prepared report; and (3) the conduct of certain secondary investigative procedures by research staff/consultants for the lead agency. Use of the guidelines in large and small scale analyses was demonstrated. Appendices cover a synopsis of legal authorities and lists of cultural resource institutions (including SHPO's) and museums/historical societies. Authority for archaelogical/historical impact analysis was considered in detail, such as the National Environmental Policy Act of 1969, requiring Federal agencies to conduct environmental impact analyses on actions significantly affecting human environmental quality. 'Significance' is elaborated under categories of historical, scientific research, ethnic, and public significance, for the purposes of this report. (Zielinski-IPA)
W81-00045

THE MANGROVE SWAMP - AN ECOSYSTEM IN DANGER,
Swedish Water and Air Pollution Research Lab., Stockholm.
For primary bibliographic entry see Field 4C.
W81-00206

LAKE GENEVA (LEMAN): RESTORING THE BALANCE,
Foundation Ripaille, Thonon-les-Bains (France).
For primary bibliographic entry see Field 5C.
W81-00215

7. RESOURCES DATA

7A. Network Design

RESEARCH PRIORITIES IN TROPICAL BIOLOGY,
National Research Council, Washington, DC. Assembly of Life Sciences.
J. J. Talbot.
Environmental Conservation, Vol 7, No 2, p 99-100, Summer, 1980. 1 Ref.

Descriptors: *Tropical regions, *Research priorities, *Land use, *Ecology, Rain forests, Wet climates, Water resources, Rivers, Lakes, Watershed management, Water chemistry, Aquatic life, Urbanization, Africa, Asia, South America.

The international Committee on Research Priorities in Tropical Biology was established to devise ways of increasing the pace of basic research, concentrating on promising scientific and geographic areas. It functioned between March 1978 and March 1980 but may now be disbanded. The committee used the following criteria when choosing research topics: urgency due to imminent change in an ecological or biological system, and potential significance to biology and its supporting disciplines. The Committee recommended that the pace of biological inventory be increased in tropical regions in the next two decades. Tropical ecosystem studies, including water and nutrient cycling investigations, were urged for various forest areas. Studies of major rivers, lakes, streams, and wetlands of the tropics are of scientific importance, especially as changes such as watershed deforestation, impoundment for energy production and flood control, and urban and industrial pollution will occur in these areas. Particular areas to study include the Amazon, Orinoco, and Zaire rivers, as well as the Musi (Sumatra) and Purari (New Guinea), Lakes Valencia and Maracaibo (Venezuela), Malawi, Titicata, and volcanic lakes in southeast Asia, and wetlands like the Sudd and Benguelu in Africa, the varzea of the Amazon and Orinoco basins, and the peat swamps in southeast Asia. Water chemistry and nutrient processing, plankton, fishes, bottom fauna, certain vertebrates, and land-water interactions should be studied in these areas. (Gish-FRC)
W81-00212

7B. Data Acquisition

THE ROLE OF ZOOPLANKTON VERTICAL MIGRATION IN STRUCTURING THE PHYTOPLANKTON COMMUNITY,
New Hampshire Univ., Durham. Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W81-00021

FREQUENCY OF AGRICULTURAL AND FOREST DROUGHT IN NEW HAMPSHIRE: 1926 - 1975,
Northeastern Forest Experiment Station, Durham, NH.
C. A. Federer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-111254, Price codes: A03 in paper copy, A01 in microfiche Research Report No 26, 1980. 37 p, 8 Fig, 1 Tab, 16 Ref, 3 Append. Water Resource Research Center, University of New Hampshire, Durham. OWRT-A-999-NH (6).

Descriptors: *Drought, *Agriculture, *Forest drought, *Soil water, New Hampshire, Soil moisture, Moisture deficit, *Soil water deficits, Agricultural drought, Water deficits.

Agricultural drought is defined as a shortage of soil water for plant growth. It can be quantified in terms of soil-water deficits during the growing season. A hydrologic simulation model called BROOK was used to estimate daily soil-water deficits from daily precipitation and mean temperature for 50 years (1926-1975) at three New Hampshire locations: Berlin, Durham, and Keene. In the simulated soil, which had about 120 mm of available water, deficits greater than 60 mm may indicate occurrence of agricultural drought. This deficit is exceeded about half the time between mid-July and mid-September at all locations. Both the number of days with deficits larger than 60 mm and the mean deficit from June through August are satisfactory measures of dryness of different summers. In most

years dryness at one location was not related to dryness at the other locations, indicating that agricultural drought in New Hampshire is a local rather than a regional phenomenon. Graphs provide data on the frequency of a drought of a given length, timing, and intensity. For example, on August 1 a run of deficits exceeding 75 mm for 30 days occurred in about 15% of the years at Keene and Durham and in 7% of the years at Berlin. Soil water was always recharged before late December, so agricultural drought did not carry over from one summer to the next. Estimates of soil-water deficits are much more satisfactory than precipitation for studying the relation of drought occurrence to plant growth.
W81-00034

WATERSHED INFORMATION SYSTEM,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
A. G. Thomsen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115701, Price codes: A09 in paper copy, A01 in microfiche. Ph.D. Dissertation, Spring 1980. 161p. OWRT-B-160-COLO(3), 5-31640.

Descriptors: Snow, *Snowmelt, Hydrologic models, *Remote sensing, *Model studies, *Streamflow, Satellites(Artificial), Aerial photography, Computer program, Watersheds(Basins), Water equivalent, Topography, Vegetation, Soils, Colorado, Rocky Mountain Region, Mountain watersheds.

A watershed information system for the analysis and simulation of mountain watersheds is described. Watershed information on topography, vegetation and soils in digital terrain models (overlays) serve as the data base for watershed analysis, classification of snow in Landsat imagery and automatic generation of parameter decks for operating distributed simulation models of snowcover dynamics and streamflow generation. The computer programs that generate the parameter decks have built-in calibration options for all major processes, that permit fast model calibration from an interactive computer terminal, on watersheds with varying characteristics. Snow processes are simulated within square (5.76 ha) grid-cell elements. The hydrograph resulting from spring snowmelt is simulated by a lateral flow model of streamflow generation driven by the simulated spatially distributed input (snowmelt and rain). Options are available for simulating the effects of forest management alternatives (thinning, clearcutting) on selected forest stands. Line printer generated map overlays showing simulated snowcover parameters (depth, temperature) as well as the moisture content of the rooting zone, can be produced for any date between April 1 and July 31.
W81-00081

APPLICATIONS OF REMOTE SENSING IN HYDROLOGY,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
D. C. Fitz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-111932, Price codes: A07 in paper copy, A01 in microfiche. M.S. Professional Paper, May 1980. 131 p. OWRT-B-160-COLO(2), 5-31640.

Descriptors: *Remote sensing, *Hydrology, *Surface waters, *Subsurface water, *Instrumentation, Watershed characteristics, Aerial photography, Satellites(Artificial), Infrared radiation, Mapping, Water quality, Available water, Snow cover, Vegetation, Soils.

This paper is a summary of the potential applications of remote sensing in the field of hydrology. It includes an introduction to remote sensing, the physical principles of electromagnetic energy and many of the available sensors. Operational uses and research applications of remote sensing in areas related to watershed management are summarized.
W81-00082

EVALUATION OF MEMBRANE FILTER METHODS FOR ENUMERATION OF FAECAL COLIFORMS FROM MARINE WATER,
Massachusetts Univ., Waltham. Dept. of Environmental Sciences.
B. L. Green, W. Litsky, and K. J. Sladek.
Marine Environmental Research, Vol 3, No 4, p 267-276, September, 1980. 3 Fig, 3 Tab, 14 Ref.

Descriptors: *Membrane processes, *Filters, *Coliforms, *Sea water, Incubation, Temperature, Water sampling, Sewage bacteria, Analytical techniques, Coasts, Sewage disposal, Laboratory tests.

A 24-hr modified membrane filter technique suitable for the enumeration of fecal coliforms from chlorinated sewage effluents employs m-FC agar with a preincubation temperature of 35C for 5 hr followed by 44.5C for 18 plus or minus 1 hr. The technique was compared with the standard membrane filter process with an incubation temperature of 44.5C and the most probable number (MPN) technique for estuarine and marine environments. The study used 9 laboratory and 72 plant chlorinated primary and secondary sewage samples. Comparison of the results of the techniques demonstrated that the modified membrane filter counts were higher than the standard membrane filter technique in 64 of 68 trials, with the modified method yielding an average of 50% higher counts than the standard membrane filter method. While both membrane filter methods had correlation coefficients of 0.95 compared with the MPN, only 75% of the standard membrane filter samples were within the 95% confidence limits of the MPN, whereas 90% of the counts obtained with the modified method fell within 95% confidence limits. (Lisk-FRC)
W81-00219

COMPUTER-BASED TELECONTROL FOR BROMLEY GROUP,
For primary bibliographic entry see Field 8C.
W81-00236

APPLICATIONS OF GEOPHYSICS IN GROUNDWATER INVESTIGATIONS,
Birmingham Univ. (England).
R. D. Barker.
Water Services, Vol 84, No 1014, p 489-492, 480, August, 1980. 9 Fig, 4 Ref.

Descriptors: *Groundwater, *Subsurface mapping, *Hydrogeology, *Instrumentation, Borehole geophysics, Geophysics, Aquifers, Saline water, Valleys, Resistivity, Gravimetry, Seismographs.

The use of geophysical techniques in investigating the condition of groundwaters is described. The electrical resistivity technique has particular advantages in hydrogeology in that it responds to variations in conductivity of the groundwater. This technique allows the land itself to remain undamaged. The gravity method is usually employed for reconnaissance purposes, particularly for locating faulted and other structural boundaries and for mapping of alluvium filled valleys. The seismic technique may be used to determine the depth to the base of alluvium. Induced polarization is used in hydrogeological surveys to distinguish between pure sands of high permeability and sands with disseminated clays of lower permeability. Four case histories are presented, three of which discuss the use of the resistivity technique. One case discusses the mapping of an aquifer structure. The second case describes the use of geophysical surveys to site a single borehole accurately. The third problem called for identification of the extent of the saline groundwater in a particular area and study of the subdrift geology and positions of major faults. The fourth case involves investigation of a buried drift-filled valley in Essex, England. (Baker-FRC)
W81-00237

PORTABLE INSTRUMENTATION TO MONITOR FLOW RATE AND VOLUME,
Georgia Univ., Athens.
R. Harrell, J. M. Allison, B. D. McLendon, and M. Lawrence.
Agricultural Engineering, Vol 61 No 5, p 12-13, May, 1980. 1 Fig.

Descriptors: *Flowmeters, *Monitoring, *Flow measurement, *On site data collection, Flow, Flow rates, Spraying, Volume, Velocity, Water measurement.

A description is given of a portable instrument designed to monitor flow rate and volume. The combination of display multiplexing and Complementary Metal Oxide Semiconductor (CMOS) Integrated Circuits makes battery operation of the circuit feasible, so that the system is portable. The display can be turned off and on without interrupting count operations, thus extending battery life. A panel switch makes it possible to reset the accumulator to zero. The device may be used in water flow systems, but could be equally well applied to measure air speed, revolutions per minute, ground speed, and other variables. It might also prove useful in measuring from sprayer applications where both flow rate and total volume are of interest. (Baker-FRC)
W81-00240

7C. Evaluation, Processing and Publication

HYDROLOGIC SETTING OF WILLIAMS LAKE, HUBBARD COUNTY, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2H.
W81-00050

THE U.S. GEOLOGICAL SURVEY IN ALASKA, 1980 PROGRAMS,
Geological Survey, Anchorage, AK. Water Resources Div.
Geological Survey Circular 823-A, 1980. 112 p, 23 Fig, 4 Tab, (Reed, K. M., editor).

Descriptors: *Alaska, Projects, *Natural resources, *Research and development, Energy, Mineralogy, Topographic mapping, Geology, Water resources, Investigations, Conservation, Oil, *U. S. Geological Survey, *Outer Continental shelf, National Petroleum Reserve in Alaska, *Federal reservations, Indian reservations.

This circular describes the 1980 programs of the U.S. Geological Survey in Alaska. A brief description of the Alaskan operations of each major division of the Survey is followed by project descriptions arranged by geographic regions in which the work takes place. The mission of the Geological Survey is to identify the Nation's land, water, energy, and mineral resources; to classify federally-owned mineral lands and waterpower sites; to resolve the exploration and development of energy and natural resources on Federal and Indian lands; and to explore and appraise the petroleum potential of the National Petroleum Reserve in Alaska. Alaska is at once the largest, the least populated, the least explored, and the least developed State in the Nation. More than half of the Nation's 600 million acres of Outer Continental Shelf lies off Alaska's coast. The land area of Alaska contains 375 million acres, 16 percent of the onshore land of the Nation. Its resources of all kinds present an opportunity to demonstrate how the needs of both conservation and development can be met for the benefit of the American people. (USGS)
W81-00051

SURFICIAL GEOLOGY OF PENNELLVILLE QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. S. Miller.
Available from OFSS, Box 25425, Fed. Ctr., Denver, CO. 80225, Paper copy $2.00, Microfiche $4.00. Geological Survey Open-File Report 80-411 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, *Natural resources,

*New York, Water wells, Water yield, Maps, *Oswego County(NY).

The location and extent of 10 kinds of surficial deposits in Pennellville quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for ground-water development at any specific location. (USGS)
W81-00055

PRELIMINARY BATHYMETRY OF MC CARTY FIORD AND NEOGLACIAL CHANGES OF MC CARTY GLACIER, ALASKA,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2C.
W81-00056

PRELIMINARY BATHYMETRY OF AIALAK BAY AND NEOGLACIAL CHANGES OF AIALIK AND PEDERSON GLACIERS, ALASKA,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2C.
W81-00057

WATER RESOURCES DATA FOR PENNSYLVANIA, WATER YEAR 1979--VOLUME 3, OHIO RIVER AND ST. LAWRENCE RIVER BASINS,
Geological Survey, Harrisburg, PA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-223951, Price codes: A17 in paper copy, A01 in microfiche.
Geological Survey Water-Data Report PA-79-3, June 1980. 386 p, 7 Fig.

Descriptors: *Pennsylvania, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Ohio River basin(PA), St. Lawrence River basin(PA).

Water resources data for the 1979 water year for Pennsylvania consist of records of discharge and water quality of streams; contents of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 86 gaging stations, contents at 22 lakes and reservoirs, water quality at 28 gaging stations and 11 wells, and water levels at 23 observation wells. Also included are data for 11 crest-stage, 28 low-flow, and 312 water-quality partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in volumes 1 and 2 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Pennsylvania. (USGS)
W81-00061

WATER RESOURCES DATA FOR SOUTH CAROLINA, WATER YEAR 1979,
Geological Survey, Columbia, SC. Water Resources Div.
Geological Survey Water-Data Report SC-79-1, June 1980. 302 p, 5 Fig.

Descriptors: *South Carolina, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for South Carolina consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 57 gaging stations, stage-only records for 1 gaging station, stage and contents for 11 lakes and reservoirs, water quality for 25 gaging stations and 5 ungaged stations, and water levels for 23 observation wells. Also included are 46 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in South Carolina. (USGS)
W81-00062

WATER RESOURCES DATA FOR ILLINOIS, WATER YEAR 1979--VOLUME 2. ILLINOIS RIVER BASIN,
Geological Survey, Champaign, IL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-205230, Price codes: A18 in paper copy, A01 in microfiche.
Geological Survey Water-Data Report IL-79-2, May 1980. 401 p, 4 Fig.

Descriptors: *Illinois, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Illinois River basin

Water resources data for the 1979 water year for Illinois consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 85 gaging stations, stage only at 2 gaging stations, stage only at 3 lake stations, water quality at 92 gaging stations and 25 wells, and water levels at 3 observation wells. Also included are data for 96 crest-stage partial-record stations and 42 flood-profile stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in volume 1 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Illinois. (USGS)
W81-00063

AN ECOLOGICAL CHARACTERIZATION OF THE PACIFIC NORTHWEST COASTAL REGION. VOLUME 1. CONCEPTUAL MODEL,
Ryckman, Edgerley, Tomlinson and Associates, Inc., Bellevue, WA.
C. M. Proctor, J. C. Garcia, D. V. Galvin, T. Joyner, and G. C. Lewis.
Department of the Interior Fish and Wildlife Service Publication FWS/OBS-79/11, July 1980. 224 p, 96 Fig, 22 Tab, 186 Ref. 14-16-0009-77-019.

Descriptors: *Computer models, *Ecological distribution, *Environment, *Habitats, *Coasts, Data collections, Information exchange, Computer simulation, Data processing, Mathematical models, Programs(Computer), Simulation analysis, Model studies, Experimental models, Statistical models, Ecology, Ecosystems, Distribution, Balances of nature, Environmental gradient, Microenvironment, Basic data collections, *Pacific Northwest U.S.

A conceptual model was developed as the approach to ecological characterization of the Pacific Northwest Coastal Region, and used as a framework for collection, organization, and synthesis of data for the Characterization Atlas (Volumes 2-4). Model development was an iterative process, ranging from a 1977 Pilot Study Report and monthly Reports, to drafts of the Conceptual Model. Earlier drafts were used in preparing parts of the Test Characterization (Pilot Study), and the Model was modified following application to data collection to adjust for conceptual deficiencies. It was retested in characterization, with process reiteration, to yield the resultant Conceptual Model. This Model and the ecological models and submodels within it proved to be an integral framework for preparing the Characterization Atlas starting in Volume 2. It was concluded that the model approach for providing a conceptual framework for preparation and evaluation of ecological characterization studies represented a valid concept. Future work should involve further model modification/refinement as experience in application to natural systems is gained; and integration of the conceptual approach with mathematical modeling. Ecological modeling (Part 1) included specific considerations of the physiochemical, biological, and socioeconomic environments. Parts 2 and 3 respectively, considered specific zones/habitats and provided reference data. (Zielinski-IPA)
W81-00094

AN ECOLOGICAL CHARACTERIZATION OF THE PACIFIC NORTHWEST COASTAL REGION. VOLUME 2. CHARACTERIZATION--ATLAS REGIONAL SYNOPSIS,
Ryckman, Edgerley, Tomlinson and Associates, Inc., Bellevue, WA.
C. M. Proctor, J. C. Garcia, D. V. Galvin, G. C. Lewis, and L. C. Loehr.
Department of the Interior Fish and Wildlife Service Publication FWS/OBS-79/12, July 1980. 570 p, 165 Fig, 194 Tab, 820 Ref. 14-16-0009-77-019.

Descriptors: Data collections, Information exchange, *Computer models, *Ecological distribution, *Habitats, *Environment, *Coasts, Computer simulation, Data processing, Mathematical models, Programs(Computer), Simulation analysis, Model studies, Experimental models, Statistical models, Ecology, Ecosystems, Distribution, Balance of nature, Environmental gradient, Microenvironment, Basic data collections, *Pacific Northwest U.S.

Following completion of the Pilot Study reported in 1977, it became evident that use of a reporting structure, in which the Conceptual Model (Vol. 1) was to contain considerable regional data plus zone/habitat descriptions and habitat-specific models, was unsatisfactory for two reasons: (1) the physical bulk of material for the Conceptual Model was prohibitive; (2) more importantly, much material in the 1977 Conceptual Model really belonged in this Characterization Atlas. Thus, the reports structure was changed to that described in this Volume. This Regional Synopsis of the Characterization Atlas (Volume 2) contains a users' guide to access the characterizational information, and is comprised of three principal parts. Part I compiles regional characterizational information, covering the detailed features of the physical, biological, and socioeconomic environments of the coastal ecosystem. Part II reports on species of concern for twenty types of vegetative and land-based and marine animal species; while Part III contains reference data on symbols and terms. Volumes 3 and 4 of this ecological characterization deal with zone and habitat, and watershed descriptions, respectively; Volume 5 represents the data source appendix, containing data tapes and printouts. (Zielinski-IPA)
W81-00095

PRELIMINARY BATHYMETRY--ESTHER PASSAGE AND CHANNELS EAST TO EAGLEK ISLAND, ALASKA,
Geological Survey, Tacoma, WA. Water Resources Div.
A. Post.
Geological Survey Open-File Report 80-426, 1980 1 Sheet.

Descriptors: *Bathymetry, *Coasts, *Alaska, *Hydrography, *Navigation, Depth, Rocks, Hazards, Sounding, *Esther Passage(Alaska).

A map, scale 1:20,000, shows water depths, rocks, and hazards to navigation. These data are noted on track lines run by the Research Vessel Growler in Alaskan waters, where data on navigation shown on published charts are nonexistant, preliminary, or out dated. (USGS)
W81-00137

PRELIMINARY BATHYMETRY OF BLACKSTONE BAY AND NEOGLACIAL CHANGES OF BLACKSTONE GLACIERS, ALASKA,

Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2C.
W81-00138

PRELIMINARY BATHYMETRY--APPROACHES TO UNAKWIK INLET, ALASKA,
Geological Survey, Tacoma, WA. Water Resources Div.
A. Post.
Geological Survey Open-File Report 80-428, 1980. 1 Sheet.

Descriptors: *Bathymetry, *Coasts, *Alaska, *Hydrography, *Navigation, Depth, Rocks, Hazards, Sounding, *Unakwik Inlet(Alaska).

A map, scale 1:20,000, shows water depths, rocks, and hazards to navigation. These data are noted on track lines run by the Research Vessel Growler in Alaskan waters, where data on navigation shown on published charts are nonexistant, preliminary, or out dated. (USGS)
W81-00139

PRELIMINARY BATHYMETRY OF NORTHWESTERN FIORD AND NEOGLACIAL CHANGES OF NORTHWESTERN GLACIER, ALASKA,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2C.
W81-00140

POTENTIOMETRIC SURFACE OF FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND ADJACENT AREAS, MAY 1979,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-00141

SEASONAL AND ANNUAL VARIATIONS IN THE POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER IN DUVAL COUNTY, FLORIDA, 1960-77,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. W. Leve.
ogical Survey Open-File Report 80-164 (WRI), 1980. 1 Sheet, 4 Fig, 2 Ref.

Descriptors: *Maps, *Aquifers, *Water levels, *Potentiometric level, *Florida, Groundwater, Water utilization, Water wells, Water level fluctuations, *Floridan aquifer, *Duval County(FL), *Jacksonville(FL).

Potentiometric levels of the Floridan aquifer in Duval County, Fla., are constantly changing in response to gains of water to the aquifer, primarily by recharge from rainfall; and losses from the aquifer, primarily by withdrawals from hundreds of wells. Seasonal variations of the potentiometric level in one well at Jacksonville was 4.2 feet during 1976. During the 18 year period from 1960 to 1977 the mean annual decline of potentiometric levels in the county was about 8 feet because of a large increase in withdrawals and to a lesser extent a decline in average annual rainfall in recharge areas. Maps of the potentiometric surface in 1960 and 1977 indicate that the greatest decline was more than 20 feet in the south-central part of the county. The decline was less than 5 feet in the western part of the county. (Kosco-USGS)
W81-00142

GROUND WATER IN OSCEOLA COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. M. Frazee, Jr.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225, paper copy $3.50, microfiche $0.50. Geoological Survey Open-File Report 79-1595 (WRI), 1980. 1 Sheet, 6 Fig, 11 Ref.

Descriptors: *Maps, *Groundwater, *Aquifers, *Water quality, *Florida, Aquifer characteristics, Natural recharge, Potentiometric level, Water wells, Water levels, Water supply, Geologic formations, Hydrogeology, Hydrographs, *Osceola County(FL), *Floridan aquifer.

This report describes the ground-water resources of Osceola County, Florida, with emphasis on the (1) location of the principal aquifers, (2) location of areas of ground-water recharge and discharge, (3) chemical quality of ground water, and (4) quantities of ground water available. The investigation includes an inventory of 365 wells, test drilling in unconsolidated materials overlying the Floridan aquifer, water-level measurements, and water quality sampling and analysis. (USGS)
W81-00143

CONFIGURATION OF THE TOP OF THE HIGHLY PERMEABLE DOLOMITE ZONE OF THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. M. Wolansky, G. L. Barr, and R. M. Spechler.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225, paper copy $1.75, microfiche $0.50. Geological Survey Open-File Report 80-433 (WRI), 1980. 1 Sheet, 24 Ref.

Descriptors: *Maps, *Aquifers, *Permeability, *Florida, Aquifer characteristics, Rock properties, Hydrogeology, Geohydrologic units, *Floridan aquifer, *Southwest Florida Water Management.

This map report presents the configuration of the top of the highly permeable dolomite zone of the Floridan aquifer in the Southwest Florida Water Management District. The top of the highly permeable dolomite generally corresponds to the top of a thick bed of massive, hard, dark brown dolomite occurring in the Avon Park Limestone of Eocene age. The altitude of the top of the permeable dolomite varies from about 100 feet below the National Geodetic Vertical Datum of 1929 in the north to about 1,600 feet below the datum in the south. (Kosco-USGS)
W81-00144

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1979--VOLUME 1. OHIO RIVER BASIN,
Geological Survey, Columbus, OH. Water Resources Div.
Geological Survey Water-Data Report OH-79-1, July 1980. 487 p, 2 Fig.

Descriptors: *Ohio, *Hydrlogic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Ohio River basin(OH).

Water resources data for the 1979 water year for Ohio consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in three volumes contains records for water discharge at 197 gaging stations, stage and contents at 32 lakes and reservoirs, water quality at 54 gaging stations and 49 wells, and water levels at 157 observation wells. Also included are data for 58 crest-stage partial-record stations, 26 low-flow partial-record stations, and 311 coal hydrology synoptic sites. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Ohio. (USGS)
W81-00145

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1979--VOLUME 2. ST. LAWRENCE RIVER BASIN,
Geological Survey, Columbus, OH. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-105397, Price codes: A09 in paper copy, A01 in microfiche. Geological Survey Water-Data Report OH-79-2, June 1980. 183 p, 2 Fig.

Descriptors: *Ohio, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *St. Lawrence River basin(OH).

Water resources data for the 1979 water year for Ohio consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in three volumes contains records for water discharge at 197 gaging stations, stage and contents at 32 lakes and reservoirs, water quality at 54 gaging stations and 49 wells, and water levels at 157 observation wells. Also included are data for 58 crest-stage partial-record stations; 26 low-flow partial-record stations, and 311 coal hydrology synoptic sites. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Ohio. (USGS)
W81-00146

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1979--VOLUME 3. COAL AREAS,
Geological Survey, Columbus, OH. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-105405, Price codes: A08 in paper copy, A01 in microfiche. Geological Survey Water-Data Report OH-79-3, July 1980. 160 p, 2 fig, 3 tab.

Descriptors: *Ohio, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Coal areas(OH).

Water resources data for the 1979 water year for Ohio consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in three volumes contains records for water discharge at 197 gaging stations, stage and contents at 32 lakes and reservoirs, water quality at 54 gaging stations and 49 wells, and water levels at 157 observation wells. Also included are data for 58 crest-stage partial-record stations; 26 low-flow partial-record stations, and 311 coal hydrology synoptic sites. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Ohio. (USGS)
W81-00147

WATER RESOURCES DATA FOR HAWAII AND OTHER PACIFIC AREAS, WATER YEAR 1979--VOLUME 1. HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115065, Price codes: A14 in paper copy, A01 in microfiche. Geological Survey Water-Data Report HI-79-1, June 1980. 296 p, 15 Fig, 1 Tab.

Descriptors: *Hawaii, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging

stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Volume 1 of water resources data for the 1979 water year for Hawaii and other Pacific areas consist of records of stage, discharge, and water quality of streams; and water levels and water quality in wells and springs. This report contains discharge records for 111 gaging stations; water quality for 12 gaging stations, 103 partial-record flow stations, and 157 wells; and water levels for 22 observation wells. Also included are 106 crest-stage partial-record stations and 18 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, Federal, and other agencies in Hawaii. (USGS)
W81-00148

WATER RESOURCES DATA FOR HAWAII AND OTHER PACIFIC AREAS, WATER YEAR 1979--VOLUME 2. TRUST TERRITORY OF THE PACIFIC ISLANDS, GUAM, AMERICAN SAMOA, AND NORTHERN MARIANA ISLANDS,
Geological Survey, Honolulu, HI. Water Resources Div.
Geological Survey Water-Data Report HI-79-2, June 1980. 126 p, 14 Fig.

Descriptors: *Hawaii, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Mariana Islands, *Caroline Islands, *Samoa Islands.

Volume 2 of water resources data for the 1979 water year for other Pacific areas consist of records of stage, discharge, and water quality of streams; stage of a reservoir; and water levels in wells and springs. This report contains discharge records for 41 gaging stations, stage only record for 1 gaging station, water quality for 1 gaging station and 20 partial-record stations, water temperature for 42 gaging stations, water levels for 13 observation wells, tide level for 1 tide station, and 7 water level less tide level tables. Also included are 26 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating Governments and Federal agencies in other Pacific areas. (USGS)
W81-00149

MAPS SHOWING GROUND-WATER CONDITIONS IN THE DOUGLAS BASIN AREA, COCHISE COUNTY, ARIZONA--1978,
Geological Survey, Tucson, Az. Water Resurces Div.
L. J. Mann, and C. S. English.
OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, paper copy $10.75, microfiche $1.50. Geological Survey Open-File Report 80-700 (WRI), May 1980. 3 Sheets, 11 Ref.

Descriptors: *MAPS, :GROUNDWATER, :Irrigation, *Water level fluctuations, *Water quality, Aquifer characteristics, Water wells, Withdrawal, Pumping, Drawdown, Land use , Hydrographs, Arizona, *Douglas basin area(AZ), *Cochise County(AZ).

The Douglas basin area includes about 1,200 square miles in southeastern Arizona. The main use of ground water is for irrigation. For 1955-77, the estimated ground-water pumpage equaled or exceeded 50,000 acre-feet per year, and for 1966-77, the ground-water pumpage averaged about 109,000 acre-feet per year. Ground-water withdrawals have resulted in water-level declines in most of the area. Information shown on the maps includes change in water level (1966-78) and irrigated area; depth to water and altitude of the water level; and chemical quality of the water and well depth. Hydrographs of the water level in selected wells and a table of historical pumpage also are included Scale 1:125,000. (USGS)
W81-00155

MAPS SHOWING GROUND-WATER CONDITIONS IN THE UPPER VERDE RIVER AREA, YAVAPAI AND COCONINO COUNTIES, ARIZONA--1978,
Geological Survey, Tucson, Az. Water Resources Div.
G. W. Levings, and L. J. Mann
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, paper copy $9.50, microfiche $1.00. Geological Survey Open-File Report 80-726 (WRI), April 1980. 2 Sheets, 10 Ref.

Descriptors: *Maps, *Groundwater, *Aquifer characteristics, *Water table, *Water quality, Hydrogeology, Water supply, Water utilization, Water yield, Irrigation, Water wells, Water analysis, Fluorides, *Upper Verde River area(AZ), *Yavapai County(Az), Coconino County(AZ).

The upper Verde River area includes about 3,600 square miles in north-central Arizona. The area is underlain by a regional aquifer that consists of several formations. In places ground water also is present in the igneous rocks and basalt flows and in the alluvium along the channels and flood plains of the streams. Ground-water development has been slight; in 1978 about 8,000 acre-feet of ground water was withdrawn for domestic, public-supply, industrial, and irrigation uses. Information on the maps includes the principal geologic formation that furnishes water to wells and springs, depth to water, altitude of the water level, and chemical quality of the water. Scale 1:125,000. (USGS)
W81-00156

SHIFTING LEVEL MODELLING OF HYDROLOGIC SERIES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W81-00207

8. ENGINEERING WORKS

8A. Structures

HYDRAULIC DESIGN OF BRIDGES WITH RISK ANALYSIS,
Geological Survey, NSTL Station, MS. Water Resources Div.
V. R. Schneider, and K. V. Wilson.
Federal Highway Administration report, FHWA-TS-80-226, March 1980. 138 p, 7 Fig, 3 Tab, 22 Ref, 2 Append. P O 5-3-0194.

Descriptors: *Hydraulic design, *Bridges, *Risks, *Analytical techniques, *Economic life, Design flood, Flood plains, Highway effects, Backwater, Flow profiles, Open channel flow, Channel morphology, Construction, Costs, Project planning, Design data, *Risk analysis.

This manual presents example studies and reports which implement the philosophy that the total stream crossing including the approach fills in the flood plains and all necessary waterway openings should be designed and constructed for the least total expected cost to the public. The total expected cost includes the capital investment in the highway, expected replacement and repair costs as a result of flood damages, expected user costs from traffic interruption and detour, and expected backwater drainages during the service life of the highway. Techniques for making engineering and economic studies for the least cost designs are presented along with suggestions for managing the time and work required for such studies. A unique design flood is defined for each bridge as the flood whose upstream stage is equal to the lowest elevation of the approach fill or bridge deck. Two example reports were prepared to illustrate the application of the method to a rural site (low backwater damage) and an urban site (high potential traffic interruption and backwater damage). (USGS)
W81-00054

DRAINAGE FOR AN INDUSTRY/OFFICE COMPLEX,
Halff (Albert H.) Associates, Inc., Dallas, TX.
For primary bibliographic entry see Field 4A.
W81-00211

OXFORD CITY GETS NEW TRUNK OUTFALL SEWER. WEDGE BLOCK TUNNEL SAVES CHRISTCHURCH MEADOWS AND 3 MILLION POUNDS,
Water Services, Vol 84, No 1014, p 507-508, 511-512, August, 1980. 3 Fig.

Descriptors: *Outfall sewers, *Tunnels, *Pumping plants, *Municipal wastes, *Sewerage, Sewers, Geological surveys, Underground structures, Costs, Social aspects, Water yield

Use of a wedge-block lining technique to upgrade an overloaded sewer system for the City of Oxford, England, is described. The block tunnel was designed to replace the existing outfall sewer with a new low-level pumping station to lift the flow about 12 m from the tunnel outfall to the level of the existing inlet to the pretreatment plant. When this was completed, the plan called for a detailed survey of the existing brick-ring trunk sewer to determine whether it should be repaired or filled in. It was estimated that use of the wedge-block lining technique in this particular problem area allowed the savings of large amounts of money by the City. (Baker-FRC)
W81-00234

CLEANER TYNE.
For primary bibliographic entry see Field 5D.
W81-00239

8C. Hydraulic Machinery

COMPUTER-BASED TELECONTROL FOR BROMLEY GROUP,
Water Services, Vol 84, No 1014, p 495-496, August, 1980. 2 Fig.

Descriptors: *Pumping plants, *Control systems, *Computers, *Monitoring, *Instrumentation, Computer programs, Pumping, Pressure measuring instruments, Flow measurement, Flow rates, Distribution systems, Pipelines, Water conveyance, Reservoir storage.

Updating of the Bromley Area Water Pumping Scheme in England was conducted over a 4-year period. More modern equipment was added to older pumping stations and a control center was established at the Orpington station to house the new maintenance center that will service the Kent area. A large instrumentation console was built at the Shortlands station to monitor valve positions, pump currents, flows, pressure and levels. A micro-computer-based process controller was installed at the Orpington facility to check alarms on pressures, flows, chemical treatment/aeration tank operation and initiate corrective actions when faulty conditions occur. A computer-based telecontrol system was set up to supervise the rebuilt stations plus the West Wickham and Brasted stations based on the Type 1000 modular digital telemetry. The centralized scheme was programmed so that a fault anywhere in the system could not cause complete loss of monitoring and control. A separate recording panel was installed to allow continuous monitoring and a micro-computer system was added to process the data for future analysis and recording. Daily measurements could be obtained from two visual display terminal units (VDU) with a printer. Tracking of alarm locations from the VDU is described. A display in the control room shows by color codes which stage of water purification the system is handling. Other

control room displays and scalings are described. In the event of a computer control system failure, the controls may be actioned directly through the telemetry system. The use of computers has made the control of water a more precise art. (Geiger-FRC)
W81-00236

8I. Fisheries Engineering

NIGHTTIME AERATION TO INCREASE PRODUCTION OF CHANNEL CATFISH,
Auburn Univ., AL.
W. D. Hollerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-111296, Price codes: A03 in paper copy, A01 in microfiche. MS thesis, 1980, 33 p, 6 Fig, 5 Tab. OWRT B-076-ALA (4), 14-34-0001-8001.

Descriptors: *Channel catfish, *Aeration, Dissolved oxygen, Economics, *Fish farming, *Ponds, Fish populations, Number of fish per acre, Water quality, Fish diseases, Fish production, Alabama.

Channel Catfish (Ictalurus punctatus) were stocked in 0.02- to 0.04- hectare ponds at 20,385 per hectare and fed daily. Fish averaged 11 cm total length and 6.2 g at stocking. Six ponds received daily nighttime aeration (2 to 6 hours) and six ponds received no aeration. A maximum feeding rate of 90 kg/hectare was reached by midsummer. In the aerated treatment, no dissolved oxygen (DO) problems occurred, and survival was 92%. Fish mortalities resulted from DO depletion in all ponds of the unaerated treatment, and survival was 40%. Nitrite-nitrogen concentrations were significantly higher in the aerated treatment, though never at levels reported as lethal to channel catfish. Concentrations of un-ionized ammonia in both treatments were high enough to have adversely affected growth. The aerated treatment produced an average 5,807 kg/hectare of channel catfish and had a net economic gain of $1,500 per hectare. The unaerated treatment produced an average 1,400 kg/hectare and was an obvious economic failure.
W81-00008

LIQUID AMMONIUM POLYPHOSPHATE AS A FISH POND FERTILIZER,
Auburn Univ., AL.
R. J. Metzger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-111288, Price codes: A03 in paper copy, A01 in microfiche. MS thesis, 1980, 30 p, 4 Fig, 3 Tab. OWRT B-076-ALA (5), 14-34-0001-9101.

Descriptors: *Sunfish, Ponds, *Fertilizers, *Fish farming, Costs, Evaluation, Fish populations, Number fish per acre, * Amonium phosphate, Fish production, Liquid ammonium phosphate.

Sunfish ponds were fertilized 11 times during the growing season with liquid ammonium polyphosphate (13-38-0) at 5.6, 11.2, or 22.4 kg hectare super -1 application super -1. Net production of sunfish averaged 310, 315, and 418 kg/hectare in the low, medium, and high treatments, respectively. Net production of the high treatment differed from net production of the other two treatments. These findings suggest that 5.6 kg hectare super -1 application super -1 of liquid ammonium polyphosphate is suitable fertilization for woodland ponds with low to moderate fishing. A rate of 22.4 kg hectare super -1 application super -1 is adequate in woodland ponds with heavy fishing. Uniform surface application was the most effective technique of applying liquid ammonium polyphosphate. Liquid ammonium polyphosphate fertilization would generally be cheaper than fertilization with conventional granular fertilizers.
W81-00009

THE USE OF PERIODIC LIGHT APPLICATIONS OF ROTENONE AS A MANAGEMENT TECHNIQUE FOR SMALL IMPOUNDMENTS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.

For primary bibliographic entry see Field 2H.
W81-00119

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

BIBLIOGRAPHY OF GEOLOGY AND HYDROLOGY, SOUTHWESTERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
A. F. Wright.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-199961, Price codes: A12 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-20, January 1980. 255 p, 1 Fig.

Descriptors: *Bibliographies, *Geology, *Hydrology, *Natural resources, *New Mexico, Oil, Natural gas, Potash, Coals, Chemistry, Southwestern New Mexico.

The southwestern part of New Mexico is recognized as a source of abundant and varied natural resources. This bibliography of over 2,700 references concerned with geology, hydrology, chemistry, and geography has been compiled to assist physical science researchers in their study and development of this region. (USGS)
W81-00059

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 14, NUMBER 2
JANUARY 15, 1981

W81-00251 - W81-00500
CODEN: SWRABW

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

VOLUME 14, NUMBER 2
JANUARY 15, 1981

W81-00251 -- W81-00500

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Office of Water Research and Technology. The cumlative SWRA file from 1968 and montlhy updates are available also in magnetic tape through lease from NTIS.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

BOUNDARY MIXING IN DENSITY-STRATIFIED FLUIDS,
California Univ., Berkeley.
G. N. Ivey.
Phd Dissertation July 1980. 123 p, 40 Fig, 4 Tab, 52 Ref. (California Water Resources Center Project UCAL-WRC-W-525).

Descriptors: *Boundary processes, *Vertical migration, *Turbulence, *Density, *Stratification, *Mixing, Oceans, Hypolimnion, Epilimnion, Flux, Lakes, Physical properties, Dyes, Pycnocline.

A knowledge of mixing processes in the world's natural water bodies is vital to understanding many aspects of water quality control. These water bodies are commonly density-stratified and the stratification inhibits the mixing processes. One proposed and as yet poorly understood mechanism of mixing in density-stratified fluids is caused by turbulence at boundaries which cross isopycnic surfaces. This study utilizes a laboratory experiment to investigate a simple example of such mixing. Dye observations suggest that very little vertical mixing occurs in the interior as a result of the intrusions. The net vertical mass flux, which is both observed and measured in the experiment, is accompanied by a gradual change in the vertical density distribution. The dependence of the net vertical mass flux on several parameters is measured and the results are compared with the existing models of boundary mixing. (Garrison-Omniplan)
W81-00390

A BIOLOGIST'S VIEW ON THE ROLE OF WATER CHEMISTRY IN ENVIRONMENTAL ASSESSMENT,
Department of Indian and Northern Affairs, Ottawa (Ontario).
E. K. Langtry.
In: Proceedings of the Technology Transfer Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 1, p 14, 127-138, 1979. 2 Fig, 2 Tab, 1 Ref.

Descriptors: *Environmental impact assessment, *Arctic, *Northern development, *Environmental effects, *Water chemistry, Water quality, Limnology, Water properties, Biological properties, Sampling, Water analysis, Canada.

Water chemistry is important for environmental assessment purposes, but traditional studies have often failed to assist in impact predictions. Biological analysis by itself does not define water quality precisely and should be correlated with water chemistry. The variability in chemical data can be controlled and identified with suitable study schemes. Proper sample handling and analyses by trained chemical technicians will eliminate variance due to human error. The variability characteristic of natural waters, both temporally and spotially, can be accurately estimated by careful selection of sampling frequencies and good network design. Chemical studies will achieve their maximum value when they are integrated with research in other environmental disciplines. A thorough understanding of ecological processes can be gained through intensive research on selected aquatic systems, rather than by reconnaissance type inventorying. The predictive capability that will be generated from modelling exercises will improve the quality of environmental impact evaluations. (WATDOC)
W81-00462

1B. Aqueous Solutions and Suspensions

ANALYSES OF WATER, BANK MATERIAL, BOTTOM MATERIAL, AND ELUTRIATE SAMPLES COLLECTED NEAR BELZONI, MISSISSIPPI (UPPER YAZOO PROJECTS),
Geological Survey, Baton Rouge, LA. Water Resources Div.
D. B. Brightbill, and J. B. Treadway, Jr.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225, Paper copy $2.25, microfiche $4.00. Geological Survey Open-File Report 80-758, July 1980. 11 p, 1 Fig, 1 Plate, 4 Tab, 11 Ref.

Descriptors: *Water analysis, *Water quality, *Core drilling, *Bottom sediments, *Chemical analysis, Dredging, Flood control, Heavy metals, Pesticides, Physical properties, Sediments, Particle size, Hydrologic data, Mississippi, *Upper Yazoo projects.

Four core-material-sampling sites and one bottom-material site were chosen by the U.S. Army Corps of Engineers to represent areas of proposed dredging activity along a 24.9-mile reach of the upper Yazoo River. Five receiving-water sites also were selected to represent the water that will contact the proposed dredged material. Chemical and physical analyses were performed upon core or bottom material and native-water (receiving-water) samples from these sites as well as upon elutriate samples of the mixture of sediment and receiving water. The results of these analyses are presented without interpertation. (USGS)
W81-00355

PARTICULAR SOLUTIONS TO THE PROBLEM OF HORIZONTAL FLOW OF WATER AND AIR THROUGH POROUS MEDIA NEAR A WETTING FRONT,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 7B.
W81-00496

2. WATER CYCLE

2A. General

HYDROLOGIC DATA FROM UPPER GRANGE HALL CREEK BASIN, NORTHGLENN, ADAMS COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00366

BASIN STUDY: BATHURST ISLANDS, 1976,
Water Survey of Canada, Ottawa (Ontario).
J. H. Wedel.
In: Proceedings of the Technology Transfer Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 1, p 15, 141-144, 1979.

Descriptors: *Watersheds, *Hydrologic data, Runoff, Sedimentation rates, Snowmelt, Mathematical models, Flow, Sediment transport, Sediment yield, Waterbudget, *Bathurst Island, *Arctic, Canada.

An intensive basin study on Western Bathurst Island was undertaken in year two of the Arctic Islands pipeline study. The basin was situated in region of fairly uncohesive soils and little previous hydrologic data. The field program assembled meteorologic, hydrologic and sediment data for the runoff period in 1976. Subsequent analysis produced an empirical relation of runoff derived from resolute bay precipitation data, some mathematical models describing snowmelt, streamflow and sediment discharges, and values in a water budget for the basin. The results indicated that annual runoff and sedimentation rates were greater than those shown in the current hydrologic atlas. (WATDOC)
W81-00463

2C. Snow, Ice, and Frost

SPATIAL SIMULATION OF SNOW PROCESSES,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
A. G. Thomsen, and W. D. Striffler.
In: Proceedings Symposium on Watershed Management, Boise, Idaho, July 21-23, 1980. Vol I, p 326-334, (1980). American Society of Civil Engineers, New York, NY. OWRT-B-160-COLO(4), 5-31640.

Descriptors: Snow, Remote sensing, *Spatial distribution, *Model studies, *Snowfall, *Snowmelt, Watersheds(Basins), Snow cover, Moisture content, Streamflow, Topography, Vegetation, Soils, *Colorado, Rocky Mountains.

A spatially distributed model for the simulation of snow accumulation and melt in the Central Rocky Mountains in Colorado is discussed. Snow processes are simulated within square (5.76 ha) grid cell elements. Parameter decks for operating the simulation model on specified watersheds are generated automatically from watershed information (topography, vegetation and soils) in digital terrain models. The computer program that generates the parameter deck, has calibration options for all major processes which permits model calibration on watersheds with varying characteristics within the region. The hydrograph resulting from spring snowmelt is simulated by a lateral flow model of streamflow generation driven by the spatially distributed input (snowmelt + rain). Parameter decks for operating the lateral flow model are likewise generated automatically from digital terrain models. Line printer generated map overlays, showing simulated snowcover parameters (depth, temperature) as well as the moisture content of the rooting zone, can be produced for any date between April 1 and July 31.
W81-00381

GLACIER SURVEYS IN BRITISH COLUMBIA - 1978,
Inland Waters Directorate, Ottawa (Ontario).
I. A. Reid, and I. O. G. Charbonneau.
Report Series No 66, 1980. 23 p, 9 Ref, 39 Tab, 8 Fig, Maps.

Descriptors: *Glaciers, *Surveys, *History, *Aerial photography, Topographical maps, British Columbia, Alberta, Hydrological studies, Stereoscopic terrestrial surveys, Water supply, Snowmelt, Water storage, Streamflow, *Canada.

Glaciers act as natural regulators, storing water in winter and releasing it in summer. To gain some understanding of this phenomenon and the contribution which glaciers make to streamflow, the predecessors of the Water Survey of Canada began glacier surveys in 1945. The earlier surveys offered some clue to the role of the glacier, but the data collected were not sufficient to provide the overall picture. Following adoption of photogrammetric survey techniques, however, the glacier surveys have evolved to the extent that it is now feasible to produce a series of maps from which the linear, areal, directional and volumetric changes can be determined. The surveys have revealed that the glaciers, in general, are becoming smaller in size; hence the regulating effect on streamflow is dimishing. (WATDOC)
W81-00385

CREEP AND GLIDE PROCESSES IN MOUNTAIN SNOWPACKS,
National Hydrology Research Inst., Ottawa (Ontario).
D. M. McClung.
NHRI Paper No 6, 1980. 66 p, 19 Fig, 32 Ref, 1 Tab.

Descriptors: *Avalanches, *Snowpacks, *Physics, *Models, *Velocity, Snow pressure, Shear stress, Strain rates, Snow pressure, Poisson ratios, Creep, Glide, Deformation, *Canada.

Group 2C—Snow, Ice, and Frost

Creep and glide processes in mountain snowpacks are discussed from the point of view of relevant constitutive equations for internal deformation (creep) in the material and slip boundary conditions (glide) at the base of slabs or the entire snowpack. The emphasis on the creep equations is to attain a formulation which is easily applicable in problems and which matches the known characteristics of field data rather that the most general equation. For glide, constitutive equations relating drag shear stress, tau, to slip velocity are given for three mechanisms for neutral zone conditions and a step toward the formulation of a general theory of snow gliding is made. Non-neutral zone glide boundary conditions are also introduced, and these are related to release of full depth and wet slab avalanches and to the problem of snow pressure on avalanche defence structures. Porous media effects on glide are also discussed. (WATDOC)
W81-00387

DISCUSSION ON SNOWMELT,
Waterloo Univ. (Ontario). Dept. Systems Design.
P. Baracos.
In: Proceedings of the Technology Transfer Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-1, 1978. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 1, p 16, 147-155, 1979. 8 Ref.

Descriptors: *Environmental impact assessment, *Arctic, *Northern development, *Environmental effects, *Snowmelt, Measurement, Mathematical models, Runoff, Stochistic models, Equations, Canada.

Runoff generated from snowmelt constitutes the bulk of yearly flow in the north. Prediction of runoff volumes and their temporal distribution can be obtained from measurements of snow quantity and by modeling melt processes. Such predictions are important to water related developments, to environmental impact assessment, to estimated missing hydrometric data and to extend existing records. AES snow gauges undercatch snowfall in the barren lands and the relocation of snow by drifting is not addressed. Snow surveys, prior to runoff, supply accurate water content data provided that snow courses are designed to sample basin terrain units in a representative way. Snowmelt models may be explicit of implicit and based on meteorologic parameters in a heat balance model or be based on empirical, simple regress ion models tailored to fit site-specifics: (1) identifying the best model type, (2) estimating model parameters and (3) diagnostic checking. New computer programs make the 3-stage process quite straightforward. Intervention analysis by means of stochastic models promises to be a most useful tool in impact assessment. A transter-function model relating runoff time series to precipitation and temperature is currently under development for the implicit modelling of snowmelt. The akaike information criterion provides a useful, unbiased criterion for model selection. The criterion considers goodness of statistical fit and model simplicity. (WATDOC)
W81-00464

ICE JAMMING CONCERNS AND OPERATIONAL SOLUTIONS,
Inland Waters Directorate, Halifax (Nova Scotia).
E. R. Langley.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 198-210, 1980. 4 Ref.

Descriptors: *Flood risk mapping, *Ice jams, *Hydrologic data, *Model studies, *Flood control, Recurrence intervals, Data collections, Perth-Andover, Ontario, Truro, Nova Scotia, Canada.

Examination of ice jamming case histories and the limited technical information available on the subject indicate that there is a need to develop guidelines for including the effects of ice jams in flood risk mapping work and an even greater need to obtain reliable information on ice jam events. In the meantime, it is proposed that each location be considered separately to determine the best method of including the ice jamming aspects in flood risk mapping. (WATDOC)
W81-00475

HYDRAULIC ASPECTS OF ICE JAMMING,
Canada Centre for Inland Waters, Burlington (Ontario).
G. Tsang.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979, Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 211-227, 1980. 8 Fig, 1 Tab, 7 Ref.

Descriptors: *Ice jams, Frazil ice, Crystals, *Snowmelt, Equations, Mathematics, Models, Hydraulics, Flows, Shears, Stress, Roughness, *Flood damage, *Flood control, Canada.

The physical factors affecting ice formation and ice jamming are reviewed. Although it is possible to predict the occurrence of ice jamming with a certain degree of confidence, many problems remain unsolved including ice jam flooding characteristics, instability of ice cover, and the evolution of dynamic jams and their resistance to flow. (WATDOC)
W81-00476

2D. Evaporation and Transpiration

OXYGEN EXCHANGE BETWEEN A 'MODEL' POND AND THE ATMOSPHERE,
Science and Education Administration, Durant, Southern Plains Watershed and Water Quality Lab.
O. R. Lehman.
Advances in Water Resources, Vol 3, No 2, p 87-89, June, 1980. 2 Fig, 2 Tab, 15 Ref

Descriptors: *Ponds, *Dissolved oxygen, *Air-water interfaces, Model studies, Atmosphere, Limnology, Water temperature, Winds, Rainfall, Precipitation, Weather, Air temperature, Environmental effects.

A glass-coated steel model pond 6 m in diameter and 2.5 m deep was placed in the ground under sheltered conditions to study oxygen exchange from April to December. The clean pond was filled with tap water, and disinfectant was added to control biological activity. Rain was the only uncontrolled water source. Oxygen exchange was calculated using daily dissolved oxygen measurements throughout the water column at 0800, 1300, and 1800 hr. Average oxygen exchange from April to December was 0.33 m/day. This level of exchange was in agreement with data reported for isolated surfaces in sheltered waters and in laboratory tanks, but was below values reported for large inland water bodies. The low oxygen exchange rate was attributed to a low average wind velocity (0.7 m/sec). It was suggested that the relationship of air and precipitation to water temperatures may be important in determining the rate of short-term oxygen exchange in sheltered waters. (Geiger-FRC)
W81-00495

2E. Streamflow and Runoff

PROCEEDINGS, 14TH ANNUAL MISSISSIPPI WATER RESOURCES CONFERENCE, 24-25 SEPTEMBER 1979,
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124430, Price codes: A06 in paper copy, A01 in microfiche. Conference held in Jackson, Mississippi '1979), 116 p. Water Resources Research Institute, Mississippi State University, Mississippi State. OWRT-A-999-MISS(15).

Descriptors: *Mississippi, *Conferences, *Tennessee-Tombigbee Waterway, Project planning, Environmental effects, Engineering structures, Regional economics, Dam failure, Flood damage, Erosion control, Sediment yield, Agriculture, Spillways, Mathematical studies.

Twenty of the twenty-one papers presented at the conference are given covering the areas of resource development, runoff and erosion, floods and flood plains, and water quality. Five of the papers center around the Tennessee-Tombigbee Waterway now under construction to provide a navigable waterway connecting the Tennessee River and the Gulf of Mexico. Other topics include dam safety, environmental impact assessment, streambank erosion, sediment yields, river crossings, crop damage assessment, remote monitoring systems, and water quality enhancement techniques. (See W81-00291 thru W81-00310) (Seigler-IPA)
W81-00290

STATISTICAL ANALYSIS OF STREAM EVENTS,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering
V. L. Zitta, and B. A. Mowry.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 33-41, (1979) 13 Fig, 7 Ref.

Descriptors: *Statistical analysis, *Mississippi, *Flow characteristics, Flow profiles, Flow rates, Frequency analysis, Probability, Stochastic process, Synthetic hydrology, Mathematical studies, Distribution patterns, *Streamflow, Stream gages, Water measurement.

Long term records of daily stream flows in Mississippi were used to determine: (1) the monthly distribution of time between stream events; (2) the mean annual spans between events as related to drainage area; and (3) a probability density function applicable to the distribution of maximum annual span between events. Data used were on tape furnished by the U.S. Geological Survey. The tapes were searched for the longest period of record exhibiting stationarity, homogeneity, and consistency. The Pearl River Station at Edinburg was chosen for the analysis. Mean monthly spans and standard deviation for each month of the year were determined and related to drainage area. Frequency distributions were then determined for an annual series of maximum spans. The Kolmogorov-Smirnov test of goodness of fit was used and empirical plotting positions were based on Weibull's plotting position formula. From the distribution plots it is concluded that: (1) mean monthly spans are cyclic with maximums in October and February/March and minimums in December and July/August; (2) average spans between events tend to increase with increasing drainage area; and (3) a two parameter lognormal distribution was adequate to describe the distribution of maximum annual spans at the 0.80 significance level. (See also W81-00290) (Seigler-IPA)
W81-00298

QUICK ESTIMATION OF PARAMETERS OF MUSKINGUM METHOD OF FLOOD ROUTING,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
V. P. Singh, and R. C. McCann.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 65-69, (1979) 2 Fig, 2 Tab, 26 Ref.

Descriptors: *Muskingum method, *Flood routing, *River forecasting, Mathematical models, Least squares method, Optimization, Analytical techniques, Mathematical studies, Method of moments, Method of cumulants, Probability, Parametric hydrology, Estimating.

Five methods for determining Muskingum parameters are illustrated to evaluate the efficiency of each method. The method used are: (1) least squares, (2) method of moments, (3) method of cumulants, (4) graphical, and (5) direct optimization. The Muskingum method for routing flood waves in rivers and channels was developed in 1934. It is a spatially lumped form of a continuity equation and a linear storage-discharge relationship for a specified river reach. Its effectiveness de-

pends on the accuracy of parameters estimation which is typically done graphically. The results of an application example for the various methods of determining parameters suggest that there may be more than one set of parameters for the Muskingum method. Results are comparable indicating that the trial and error graphical method is no better than the other methods. The computations needed for the method of cumulants and moments, least squares method, and the direct optimization are small and can be easily performed with a small calculator. (See also W81-00290) (Seigler-IPA)
W81-00303

VARIATIONS OF A MISSISSIPPI RIVER CROSSING WITH STAGE,
Army Engineer District, Vicksburg, MS.
J. V. Hines.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 71-79, (1979) 11 Fig, 2 Tab.

Descriptors: *Mississippi River, *Crossings, *Channel morphology, Channel erosion, Scour, Thalweg, Sedimentation, Dredging, Water levels, Flood stages, Flood damage, Streamflow, River beds, Meanders, *Vicksburg(MS).

Changes in bed elevation of a crossing as affected by a flood hydrograph were studied at a well-defined crossing near Vicksburg, Mississippi. A crossing is that reach of river within which the thalweg shifts from one side of the channel to the other. Due to sedimentation from floods some crossings in the Mississippi have required dredging to reopen the channel depths needed for navigation. Data were collected by a Mini-Ranger III automatic positioning system which consists of a control unit with an omni-directional receiving antenna on a boat. Two transponders were located on the bank so that the entire survey area was under line-of-sight conditions. The survey area was divided into a series of 30 parallel track lines which provided for 3,700 data points per square mile. Computerized plots of data were prepared and data were stored by lines as a series of depths. Results show that for a well defined crossing the bed elevation will follow a pattern similar to that of the stage hydrograph. Volume variation shows that the upper end of the crossing is scouring at the beginning. As the stage rises the crossing moves upstream and as the stage crests, volume stabilizes, then slowly increases, dhowing a short lag before the bed begins to scour. Due to the many variables involved, the results of this study should not be freely applied to all crossings. (See also W81-00290) (Seigler-IPA)
W81-00304

EXPANDED FLOODPLAIN INFORMATION STUDY FOR THE WOLF RIVER BASIN, TENNESSEE AND MISSISSIPPI: A COMPUTER SIMULATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
T. L. Engdahl, and J. G. Collins.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 81-85, (1979) 4 Fig, 3 Ref.

Descriptors: *Mississippi, *Simulation analysis, *Computer moels, Computer programs, Data processing, Flood forecasting, Hydrograph analysis, Watersheds(Basins), Hydrology, Flood profiles, Flood plains, Flood data, Flow characteristics, *Wolf River basin(MS-TN).

A simulation system was developed for the Wolf River basin to be used as a planning tool to forecast the impacts of land use, channel modifications, and the addition of hydraulic structures. The Wolf River basin is approximately 65 miles in length, ranges from 10 to 15 miles in width, and has an area of 817 square miles. There are more than 400 miles of stream channels within the basin. Data on channel and overbank roghness, precipitation, gaging, cross-sections, and other areal characteristics were obtained from various agencies. The 'Flood Hydrograph Package', HEC-1, was used to compute, route, and combine hydrographs. Forty-seven subbasins were divided into minibasins for runoff computations. A grid system of subdivisions was also used. Three data bases were used for hydrologic and hydraulic analyses. Three major supporting programs were developed in addition to the software routines for the data bases. A program written to access the cross-section file can output an input deck for a subbasin including tributaries. A program, FLOOD, accesses the water elevation files. The system developed can be easily modified for updating and research and the methodologies developed are generally applicable to any basin. A flow chart of the hydrologic-hydraulic simulation process is include. (See also W81-00290) (Seigler-IPA)
W81-00305

COMPUTERIZED AGRICULTURAL CROP FLOOD DAMAGE ASSESSMENT SYSTEM,
Army Engineer District, Vicksburg, MS.
W. B. Hobgood, and T. C. Hill.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 87-88, (1979).

Descriptors: *Flood damage, *Agriculture, *Computer programs, Crop production, Hay, Wheat, Soybeans, Pastures, Flood data, Regional flood, Assessments, Evaluation, Flood stages, Computer models.

CACFDAS, the Computerized Agricultural Crop Flood Damage Assessment System, uses historical data on a daily basis, current budget data, present cropping patterns and production techniques, and other data to evaluate flood damages. CACFDAS analyzes the effects of physical factors such as depth, duration, and seasons of flooding on crop specific flood damages. The input system consists of the following: initial reach crop distribution data, expected net and gross for each crop, alternative substitution crop data, last date of replanting data, computerized crop budget data, itemized cultural or operation practices, and digitized stage-area data. Digitized data is read until a flood is defined. Floods are divided into minifloods or bands of inundation to account for differential dryout periods. Crops are classified as spring crops, winter crops, pasture, hay, and wheat-soybean double crop. Damages are calculated on area flooded, duration, and initial crop distribution. Three output formats are available: (1) brief, reports damages per flood year and summarizes each reach; (2) normal, reports damages for each flood, for each year, for each reach; and (3) debug, reports damages for each year, for each reach, with debugging down to the 'band' level. (See also W81-00290) (Seigler-IPA)
W81-00306

CHANNEL AND DYNAMIC FLOW CHARACTERISTICS OF THE CHATTAHOOCHEE RIVER, BUFORD DAM TO GEORGIA HIGHWAY 141,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 8B.
W81-00362

WINTER WATER--THE FLOODING AT BOISE, IDAHO, JANUARY 11-12, 1979,
Geological Survey, Boise, ID. Water Resources Div.
R. W. Harper, and E. F. Hubbard.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, paper copy, $3.50, microfiche $0.50. Geological Survey Open-File Report 80-201 (WRI), 1980. 1 Sheet, 5 Fig, 1 Tab, 2 Ref.

Descriptors: *Flooding, *Idaho, *Rainfall, *Snowmelt, *Storm runoff, Air temperature, Thawing, Streams, Flood stages, Peak discharge, Indirect flood measurement, Flood damage, Water quality, Flood protection, Planning, Flood forecasting, Boise(ID).

On January 11 and 12, 1979, unseasonally warm temperatures and rain on several inches of snow lying on frozen ground caused widespread flooding in and around Boise, Idaho. Streams north of Boise crested on January 11, flooding neighborhoods in and adjacent to the mountain foothills. On January 12, streams south and west of the city reached their highest stages. Flooding was confined to ground levels and basements of homes and businesses in low-lying areas. The U.S. Geological Survey made indirect measurements of peak discharges at selected sites on streams that had the worst flooding. The peak discharges were relatively low in comparison with data from historic floods. Much more severe flooding than this event is likely to occur in the future. More data are needed on the occurrence of flooding in Boise Valley to aid in flood-protection planning. (USGS)
W81-00364

REPORT ON WORKING GROUP NO. 1. OPEN CHANNEL HYDRAULIC MODELLING,
National Water Research Inst., Burlington (Ontario).
T. M. Dick.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop, Series No 2, p 8-12, 1980.

Descriptors: *Hydraulic models, Analytical techniques, *Flood damage, Flood control, *Management, Research and development, Performance, *Open channel flow, Canada.

The choice of models for flood level prediction is limited. Of primary concern is the reliability of the calculations which are translated eventually into action to reduce flood damage. Computational problems and routines are the main concern of modellers, but management is more concerned with the result. There should be greater priority given to establishing the reliability and accuracy of models; thus more research and development activity, especially to verify statistically the performance of models, is probably needed. (WATDOC)
W81-00465

REPORT ON WORKING GROUP NO. 2. HYDROLOGIC MODELLING,
National Hydrology Research Inst., Ottawa (Ontario).
F. I. Morton, and W. Nemanishen.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 13-18, 1980. 2 Tab.

Descriptors: *Hydrologic models, Research and development, *Runoff, Workshop, Technology transfer, *Flood damage, *Flood control, Canada.

Participants were requested to address themselves to three of the workshop objectives. There were: (A) Identification of gaps in knowledge requiring research, (B) Identification of related technical questions requiring further study and/or detailed information transfer, (C) Identification of improved methods for effecting technological transfer. (WATDOC)
W81-00466

REPORT ON WORKING GROUP NO. 3. STOCHASTIC ANALYSIS AND OPERATIONAL RESEARCH,
Inland Waters Directorate, Ottawa (Ontario).
R. L. Pentland.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 19-22, 1980. 3 Tab.

Descriptors: *Flood frequency analysis, Findings, Research requirements, *Flood damage, *Flood control, Canada.

The working group discussed four broad categories: frequency analysis at gauged sites; ungauged sites and regional analysis; large lake/coastal situa-

tions and reservoir operation; and physical interventions. For each of these, the group identified findings and research needs which attempted to address, respectively, findings of general value to operational people in the flood damage reduction program, and links which should be made between the program and research-programs. The findings and conclusions are summarized. A summary is provided of more general conclusions reached by the group which are considered important to the FDR program but which could not be classified along with the more specific conclusions. Also included, for general information, is a survey of the numbers of agencies using various frequency analysis techniques. (WATDOC)
W81-00467

SIMPAK FOR RIVER BASIN STUDIES,
Inland Waters Directorate, Vancouver (British Columbia).
J. C. Y. Lee, and R. O. Lyons.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 93-109, 1980. 6 Fig.

Descriptors: *Streamflow routing, Diversion, *Flood forecasting, *River modelling, Simulation, Flow nets, Hydrologic SIMPAK program, SSARR, *Flood control, Fraser River, Columbia River, Mackenzie River, Research and development, Canada.

In several studies in the Pacific and Yukon Region, streamflow routing models have been used to determine the downstream effects of various reservoir or diversion projects. In the earlier studies, the SSARR Program was adopted as one of the vehicles for routing studies in the region. However, only a fraction of the capabilities of SSARR were required for this task. The desired result could be achieved by simply using the routing methods of the SSARR Program and building a separate program framework to do all the data handling. Thus, the simulation package (SIMPAK) for river modelling was developed and used by the Vancouver Office of Inland Waters Directorate for several river basin studies. It has been used to perform river routing and reservoir regulation, critical flood flow forecasting and other operations involving manipulation of streamflow data. The critical flood flow forecasting was developed specifically for day-to-day reservoir flood control operation. The technique derived for the forecasts is a simplified approach yet provides a workable and useful tool for reservoir operation. This paper describes the features of the program, provides a comparison with the SSARR model, and describes some applications. (WATDOC)
W81-00468

DEVELOPMENT OF A REAL-TIME OPERATIONAL MODEL FOR THE OTTAWA RIVER - A PROGRESS REPORT,
Inland Waters Directorate, Ottawa (Ontario).
G. A. Nix.
In: Proceedings of the Technology Transfer, Workshop Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 110-130, 1980. 6 Fig.

Descriptors: *Flood control, *Flood forecasting, *Model studies, Warning systems, River regulation, Ottawa River, Forecasting reservoir operation, Peak discharge, Hydrologic data, Development, Testing, Input data, Output format, Canada.

In May, 1974, a Canada-Quebec agreement was signed that initiated studies on flooding and low water problems in the Montreal region, the study report recognized that any potential for reducing flooding in the Montreal region lay in optimizing the operation of the many reservoirs in the Ottawa River basin. As a result of the recommendations in the report, the Ottawa River Regulation Planning Committee was formed in February, 1977. The Committee formed a subcommittee to recommend criteria for regulation of the Ottawa River, taking into account hydro power production, flood protection, navigation, low water problems, water quality needs and recreation. A working group was then formed to develop a mathematical model for the regulation of the Ottawa River. This report describes the progress towards the development of the model. (WATDOC)
W81-00469

HEC-2 APPLICATION AT MOOSE JAW - INPUT REQUIREMENTS AND MODEL PERFORMANCE,
Inland Waters Directorate, Regina (Saskatchewan).
R. D. Hofer.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 131-140, 1980. 2 Fig, 2 Ref.

Descriptors: *Flood control, Hydrographs, *Floodways, *Streamflow forecasting, Hydraulics, *Model studies, Hydrologic data, Reservoir operation, Flood frequency, Model performance, Peek discharge, Maximum probable floods, Moose Jaw River, Canada.

On March 8, 1978, IWD, Western and Northern region, entered into an agreement with the Saskatchewan Department of the Environment to conduct various hydraulic investigations under the Canada-Saskatchewan flood damage reduction agreement. The initial contract called for the development of 1:100 and 1:500 floodlines along the Moose Jaw River, Thunder Creek and Spring Creek. A floodway along the Moose Jaw River was also called for. The Hec-2 model was acquired for this project to carry out the streamflow modelling. This paper describes the procedures used, the modelling problems, and the results. (WATDOC)
W81-00470

MATHEMATICAL MODELLING OF THE FRASER RIVER SYSTEM,
Inland Waters Directorate, Ottawa (Ontario).
M. Sydor, and P. Zrymiak
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 141-145, 1980.

Descriptors: *Flood control, *Flood damage, *Mathematical models, *Dynamic programming, Water discharges, Sediment data, Input-output analysis, Fraser River, Canada.

A one dimensional finite difference hydrodynamic model has been applied to the complex channel system of the lower Fraser River. The input data was a set of approximately 700 cross sections collected by the Department of Public Works in 1962 and 1976. Initial success using the model was realized by calibrating to a discharge of 350,900 CFS discharge on July 12, 1976, and by simulating the June 4, 1976 river condition when 227,500 CFS was recorded. With such encouraging results, the studies are continuing and various periods are to be studied in order to determine the range of accuracy possible in using this model. (WATDOC)
W81-00471

APPLICATION OF THE DWOPER MODEL TO THE LOWER SAINT JOHN RIVER,
MacLaren (James F.), Willowdale (Ontario).
H. S. Belore, A. K. Bhattacharyya, and C. T. Bishop.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 146-162, 1980. 4 Fig, 2 Tab, 19 Ref.

Descriptors: *Flood routing, *Model studies, Flow, Hydraulics, *Flood profiles, Hydrologic data, *Flood control, Physical data, Numerical analysis, Recurrence intervals, Data base systems schematization, Mathematics, Simulation analysis, Hydrograph analysis, *Flood forecasting, Saint John River, Canada.

An unsteady flood routing model, referred to as DWOPER (Dynamic Wave Operational model), has been applied along the lower Saint John River. The model, which is representative of the state of the art in unsteady flow modelling, was selected for this application after considering a number of available hydraulic routing techniques. The model accounts for factors such as the downstream effects of the reversing falls and flow over the Trans Canada Highway to large storage areas in the Grand Lake area. Model calibration and verification simulations resulted in a good reproduction of historical flood levels. Subsequently, flood profiles associated with the 1:20 and 1:100 year recurrence interval flood events were determined along the lower Saint John River from McKinley Ferry to Lower Jemseg. (WATDOC)
W81-00472

APPLICATION OF FINITE ELEMENT METHOD IN RIVER NETWORK HYDRAULICS,
Inland Waters Directorate, Burlington (Ontario).
S. M. A. Moin.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 163-178, 1980. 8 Fig, 2 Tab, 21 Ref.

Descriptors: *Finite element analysis, Analytical techniques, Mathematics, Flow, Hydraulics, *Numerical analysis, Equations, St. Lawrence River, Parametric hydrology, Open-channel networks, *Flood damage, *Flood control, Canada.

This paper describes a finite element model of the unsteady flow regime in open channel networks. Mathematically, one dimensional unsteady flow hydraulics of open channels is described by a pair of nonlinear, partial differential equations of hyperbolic type and is solved by adopting linear elements. A predictor-corrector method for solving the nonlinear equation is utilized. Simulation capabilities of the computerized model were investigated in determining the steady state profile for the St. Lawrence River. Limited scale sensitivity analysis was conducted to study the influence of the variation of the weighting parameter. A comparison of the model output with the observed events and/or calculated values indicates the suitability of the model from the viewpoints of simulation capabilities, adoption of higher time steps, conservation of mass, flexibility of operations, and handling of complex network configurations. (WATDOC)
W81-00473

MATHEMATICAL MODELLING OF UNSTEADY FLOWS IN MOBILE BOUNDARY CHANNELS,
Canada Centre for Linland Waters, Burlington (Ontario).
B. G. Krishnappan.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 179-197, 1980. 10 Fig, 9 Ref.

Descriptors: *Mathematical models, *Numerical analysis, *Flood control, *Flood forecasting, Unsteady flow, Equations, Sediments, Flood waves, Testing, Water levels, Hydraulics, Bed levels, Model predictions, Detroit River, Rio Vista, California.

A numerical model is described which solves the unsteady flow equations for a mobile boundary channel. This model is capable of predicting the floodwave characteristics as well as the environmental impacts of man's activities in river basins. The model was verified under laboratory conditions, and a reasonably good agreement between

the model predictions and laboratory measurements was observed. (WATDOC)
W81-00474

ICE JAMMING CONCERNS AND OPERATIONAL SOLUTIONS,
Inland Waters Directorate, Halifax (Nova Scotia).
For primary bibliographic entry see Field 2C.
W81-00475

HYDRAULIC ASPECTS OF ICE JAMMING,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2C.
W81-00476

METEOROLOGICAL INPUTS FOR HYDROLOGICAL MODELS,
Atmospheric Environment Service, Toronto (Ontario). Science Service Div.
R. G. Lawford.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979, Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 231-244, 1980. 1 Fig, 9 Ref, 1 Append.

Descriptors: *Hydrologic models, *Meteorology, *Flood forecasting, *Warning systems, *Flood control, Networks, Precipitation, Temperature, Weather radar, Satellites, Canada.

Precipitation and temperature are the principal controls of the hydrologic cycle. Historical and real time data are available from Atmospheric Environment Service, and forecasts of precipitation and temperature are available from regional weather centres and from the Canadian meteorological centre. New technologies and their application to hydrologic models are discussed and a brief outline of changes that could be made to the models are suggested to provide more realistic representations of the meteorological processes. Recommendations are made for further improvement of hydrological models and their application to a flood-damage warning system. (WATDOC)
W81-00477

THE NEED FOR A REGIONAL UNIT HYDROGRAPH ANALYSIS OF ONTARIO,
Water Survey of Canada, Ottawa (Ontario).
D. Kimmett.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 245-264, 1980. 5 Fig.

Descriptors: *Hydrograph analysis, *Flood forecasting, Water resources, Unit hydrographs, Model studies, Conservation authorities, *Flood damage, *Flood control, Canada.

Many of the credibility problems associated with past hydrologic studies are related to the fact that each individual has a different understanding of unit hydrograph theory and how it is best applied. It is proposed that Water Survey of Canada develop the necessary in-house expertise and publish unit hydrograph(s) on a continuing as required basis for appropriate hydrometric stations. Recent technological advancements, the need for standards in hydrology generally, and the availability of sufficient data are further incentives for initiating such a program at this time. An informal canvass of several data users drew favorable responses to the concept. A conceptual look at what should be published is provided. (WATDOC)
W81-00478

RUNOFF FROM DEVELOPING AREAS,
Canada Centre for Inland Waters, Burlington (Ontario).
J. Marsalek.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical workshop Series No 2, p 265-276, 1980. 1 Fig, 1 Tab, 14 Ref.

Descriptors: *Hydrologic models, *Runoff, *Floods, Rainfall, Hydrology, *Watersheds(Basins), *Flood control, *Hydrometeorology, Infiltration, Flood damage, Water loss, Simulation analysis, Calibration - Varification data, Canada.

Runoff from developing areas is of particular interest in connection with flood modelling because the land development dramatically alters the watershed hydrological response. During the past 15 years, a number of models for modelling of runoff from development and refinement of these models is currently underway with particular reference to the assessment of the effects of urbanization on the watershed hydrological regimen, modelling of infiltration, and modelling of flood damages. (WATDOC)
W81-00479

FLOOD FORECASTING IN THE SAINT JOHN RIVER BASIN - MATHEMATICAL MODELLING ACTIVITIES,
Inland Waters Directorate, Halifax (Nova Scotia).
D. A. Smith.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 277-311, 1980. 5 Fig, 1 Tab, 11 Ref.

Descriptors: *Flood forecasting, *Mathematical models, *Snowmelt, *Streamflows, Hydrologic data, Meteorology, Synthesis, River routing, Flood damage, Saint John River, Canada.

The development of a flood forecasting system for the portion of the Saint John River basin in the province of New Brunswick is reviewed. The paper progresses, in chronological order, from the time when there was no forecasting system, through the first efforts to calibrate the SSARR model for the basin and the forecasting operations during the 1973 record historic flood to the present. Emphasis is placed on the mathematical modelling activities and on recent efforts to improve the forecasting system being carried out under the Canada - New Brunswick flood damage reduction program. The major concerns of the technical subcommittee for flood forecasting are presented, and the activities presently underway, or planned, to overcome some of these difficulties are discussed. (WATDOC)
W81-00480

DATA NETWORK DESIGN FOR WATERSHED FORECASTING,
Inland Waters Directorate, Halifax (Nova Scotia).
D. C. Ambler.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 312-319, 1980. 1 Fig, 6 Ref.

Descriptors: *Network design, *Hydrologic data, *Flood forecasting, Saint John River, Mathematical models, Gaging, Climatic data, *Flood control, Canada.

The paper describes the data network required to support a flood forecasting operation with particular reference to the Saint John River. Sources of error in stream gauge measurements and their influence on the hydrologic model output and forecasting are discussed. (WATDOC)
W81-00481

OTTAWA RIVER - COMPARISON OF THE HYDRO QUEBEC AND SSARR MODELS,
Inland Waters Directorate, Ottawa (Ontario).
G. E. Brown.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 320-330, 1980. 2 Tab.

Descriptors: *Flood forecasting, *Flood control, *Hydrometric models, *Watersheds(Basins), Mathematics, Equations, Streamflow discharges, Snowmelt, Model calibration, Performance, Canada.

An analysis of the forecasted watershed and streamflow discharge results for five Ottawa River basin watersheds was undertaken to compare the Hydro Quebec and SSARR natural inflow models. The Hydro Quebec model generally out-performed the SSARR model for these five particular watersheds. With respect to 10 day forecast results there was a noticeable deterioration in the SSARR model results, whereas the Hydro Quebec model showed a marginal deterioration from each day to the next of the forecast period. It is pointed out that the Hydro Quebec model was designed for relatively large watersheds calibrated to moving 7 day mean daily inflows for reservoirs at the extremity of each basin. Thus, performance of the Hydro Quebec model is uncertain for hydrometrically gauged watersheds, since the five watersheds in question were calibrated to computed reservoir inflow data. (WATDOC)
W81-00482

SHORT-TERM AND LONG-TERM HYDROMETEOROLOGICAL EPOCHS,
Inland Waters Directorate, Calgary (Alberta).
W. Nemanishan.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 331-341, 1980. 10 Fig, 17 Ref.

Descriptors: *Flood forecasting, Runoff, Model studies, *Hydrometeorology, Sea surface, Temperatures, *Flood control, Droughts, South Saskatchewan River, Equations, Hydrology, Streamflow, Canada.

Scientific evidence is becoming stronger to indicate that extraterrestrial factors, such as solar activity and lunar cycles, influence atmospheric and oceanic circulation which then combine to produce prolonged droughts or floods in specific locations of the northern hemisphere. The studies of several prominent world scientists are highlighted to show how their findings can be used to improve Inland Waters Directorate studies of western Canadian flood problems. A case history is presented to illustrate the difficulty of assigning correct return periods for rare flood events and the valuable contribution that runoff modelling can make in these cases. (WATDOC)
W81-00483

THE THREE PARAMETER LOGNORMAL DISTRIBUTION APPLIED TO REGIONAL FLOOD FREQUENCY ANALYSIS BY THE INDEX FLOOD METHOD,
Inland Waters Directorate, Ottawa (Ontario).
R. Condie.
In: Proceedings of the Technology Transfer Workshop, Modelling Activties Related to Flood Damage Reduction, Hull, Quebec, May 13-25, 1979, Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 345-353, 1980. 3 Tab, 4 Ref.

Descriptors: *Flood frequency, Maximum probable floods, Homogeneity tests, Regression analysis, Equations, Parametric hydrology, Annual flood, Regionalization, Canada.

Regional flood frequency analysis by the index flood method is in fairly common use when estimates of flood flows of specific probabilities are required at ungauged river sites. Use of this method usually assumes that the Gumbel 1 distribution gives a fair representation of the flood frequency regime throughout a homogeneous region, and the most commonly used homogeneity test is

based on sampling from that distribution. Some reservations have arisen regarding the adequacy of the Gumbel 1 distribution, but use of other distributions may have been inhabited by lack of appropriate homogeneity tests. The three parameter lognormal distribution is generally superior to the Gumbel 1 in Canada. Reasons for this choice are given and the derivation of a homogeneity test is described. Advantages and disadvantages of the index flood method are also discussed in relation to the method of direction regression on the T-year flood. (WATDOC)
W81-00484

FLOOD FREQUENCIES BY THE KINEMATIC WAVE MODEL,
Inland Waters Directorate, Vancouver (British Columbia).
R. O. Lyons.
In: Proceedings of the Technology Transfer. Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 354-368, 1980. 1 Tab, 7 Ref.

Descriptors: *Flood frequency, *Design flood, *Mathematicl models, Mathematics, *Equations, Probability, Peak discharge, Rainfall intensity, Computation, Parametric hydrology, Runoff, Meteorology, Topography, Canada.

The kinematic wave model was used by Inland Waters Directorate, Pacific and Yukon Region, as one of several methods to estimate design floods for the Alaska Highway Pipeline Investigation. This paper briefly describes the basic equations forming the model and discusses the way the model was caglibrated for the southern Yukon. The model gives a convenient method for directly estimating flood frequencies at ungauged basins. A fairly large effort in analysis of meteorological data is required, but once this is done, frequency curves can be developed quickly, cheaply, and directly. (WATDOC)
W81-00485

FLOOD FREQUENCY ANALYSIS BY POWER TRANSFORMATION,
Water Survey of Canada, Vancouver (British Columbia).
R. S. McAully.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 369-382, 1980. 1 Fig, 5 Tab.

Descriptors: *Flood frequency, *Computer programs, Power transformation method, Peak discharge, Streams, Ash River, *Model studies, Equations, Canada.

This paper describes a technique for flood frequency analysis by fitting the normal probability distribution to an annual flood series after applying what has been called a power transformation. The computer program to implement this power transformation is described and some results from analyzing 35 streams in British Columbia are presented. The power transformation method, which is very easy to apply, generally gave excellent agreement with the established log-Pearson III method. (WATDOC)
W81-00486

FLOOD FREQUENCY ANALYSIS CONCERNS IN THE ATLANTIC REGION,
Inland Waters Directorate, Halifax (Nova Scotia).
J. D. Keefe.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 383-409, 1980. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Flood frequency, *Flood forecasting, Floods, Data base, *Parameteric hydrology, Flood risk mapping program, Atlantic Canada, Flood recurrence interval, Peak discharge, Saint John River, Mathematical model, Regional floods, Canada.

This paper highlights some of the technical problems being experienced in the Atlantic region in implementing the flood risk mapping program, the approaches to overcome these problems, and the areas in which more applied research and development and/or further guidelines are required. The discussion is supported by examples from various existing or planned investigations where available. (WATDOC)
W81-00487

A FLEXIBLE FAMILY OF STACHASTIC MODELS,
Waterloo Univ. (Ontario). Dept. of System Design.
K. W. Hipel.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979, Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 422-431, 1980. 1 Tab, 18 Ref.

Descriptors: *Stochastic processes, *Flood forecasting, *Statistical models, *Synthetic hydrology, Time series analysis, Mathematics, Intervention analysis, River flow data, Spring runoff, Forest fire model, Canada.

The family of Box-Jenkins models, and other closely related stochastic models, form a group which can be used to help solve many types of problems which arise in hydrology. A model which is of particular importance in hydrology is the intervention model. This model can be employed to determine the effects of man induced or natural interventions upon the mean level of a time series, to fill in missing observations in a time series, and to answer other kinds of similar problems. Following a description of the intervention model, it is explained how the most appropriate type of intervention model can be selected to fit to a specific data set by adhering to the identification, estimation, and diagnostic check stages of model development. A number of examples confirm the importance of this model for modelling Canadian hydrological data. (WATDOC)
W81-00488

HYDROLOGIC EXTREME VALUE MODEL AND RISK ANALYSIS APPLIED TO FLOOD PLAIN MANAGEMENT,
Ecole Polytechnique, Montreal (Quebec). Dept. of Civil Engineering.
F. Ashkar, N. El-Jabi, and J. Rouselle.
In: Proceedings of the Technology Transfer Workshop, Modelling Activitis Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 432-446, 1980. 5 Fig, 5 Ref.

Descriptors: *Flood plains, *Flood plain insurance, *Zoning, Protection, Control, Mathematical models, Stachastic processes, Time series analysis, Statistical methods, Parametric hydrology, Equations, Canada.

Rational planning of flood plains may be undertaken by separating them into different zones to control their development, and basing insurance premiums on flood damage risk for each zone. The risk may be established from the relationship between the return period, or the occurrence of a given flood, and the flood level. A mathematical model based on the extreme values theory in stachastic processes has been established where the distribution function of these maximum exceedances in an interval of time (O,t) could be found. Bayesian and maximum likelihood approaches are followed in order to find the distribution function of the exceedance for a given return period when uncertainty arises in the parameters of the distribution function describing the model. The risks encountered in evaluating this exceedance using different lengths of period of record are compared. (WATDOC)
W81-00489

HYDRO CONFIGURATION MODELLING SYSTEM,
Inland Waters Directorate, Ottawa (Ontario).
D. W. Farley.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 447-455, 1980. 2 Fig, 5 Ref

Descriptors: *Model studies, *Flood control, *Linear programming, *Time series analysis, Stochastic processes, Synthetic hydrology, Dynamic programming, Reservoir operation, Mathematics, Continuity equations, Canada.

A generalized modelling package referred to as HCMS (hydro Co-figuration Modelling System) has been developed for studying multi-reservoir river systems. The package is particularly applicable to basins in which there is an existing hydroelectric generating capacity and/or a potential for further development. The package is used to evaluate proposals relating to: increased reservoir storage devoted to flood protection; new reservoirs; new installed turbine capacity; environmental requirements in terms of constrained reservoir levels or minimum flows; diversions of flow; and increased channel discharge capacity. By comparing the results of different simulated operation policies and configurations with each other and with historical performance, the planning team can readily assess the impact on flood protection, energy production, and environmental concerns. In order to expedite the modelling phase of studies, the package is endowed with a realistic optimal seeking solution routine. This optimal seeking solution routine employs a linear programming sub-routine, available from the IBM package SL-Math. As opposed to other applications of linear programming to water resource systems studies, the optimal seeking solution routine of this model does not assume perfect hindsight of time series data, nor is it restricted to critical periods of record to conform with dimensionality requirements common to other optimization models. (WATDOC)
W81-00490

A PROCEDURE FOR DETERMINING FLOOD FREQUENCIES FOR GREAT LAKES SHORELIN E,
Inland Waters Directorate, Burlington (Ontario).
D. W. Brown, R. J. Moulton, and S. M. A. Moin.
In: Proceedings of the Technology Transfer Workshop Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 456-465, 1980. 2 Fig, 4 Ref.

Descriptors: *Flood frequency, *Flood forecasting, *Model studies, Flood control, Climatology, Peak discharge, Winds, Waves, Mathematical studies, Equations.

Procedures are presented which can be used to determine flood frequencies on the Great Lakes The procedure varies according to the availability of data. The procedure is relatively simple near gauges where there are records of peak flood levels. If such data is not available, the procedure becomes more complex, as the flood frequencies must be derived by calculating wind set-up and run-up distributions from climatologic data and combining these frequency distributions with mean water level frequency distribution for the lake. (WATDOC)
W81-00491

2F. Groundwater

INVESTIGATION OF A SURFACE RESISTIVITY TECHNIQUE FOR THE ESTIMATION OF HYDRAULIC CONDUCTIVITY IN STRATIFIED DRIFT AQUIFERS,
Connecticut Univ., Storrs. Dept. of Geology and

Geophysics.
For primary bibliographic entry see Field 8B.
W81-00267

STRATIFIED BIDIRECTIONAL SEEPAGE FLOW THROUGH AN EARTHEN EMBANKMENT,
Lowe (Roger) Associates, Inc., Bellevue, WA.
For primary bibliographic entry see Field 2H.
W81-00270

AREAS OF NATURAL RECHARGE TO THE FLORIDAN AQUIFER IN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-00345

WATER LEVELS IN ARTESIAN AND NONARTESIAN AQUIFERS OF FLORIDA, 1977-78,
Geological Survey, Tallahasses, FL. Water Resources Div.
H. G. Healy.
Denver, CO. 80225. Paper copy $13.50, microfiche $3.50. Geological Survey Open-File Report 80-693, 1980. 99 p, 54 Fig, 1 Tab, 10 Ref.

Descriptors: *Groundwater resources, *Water levels, *Florida, *Aquifer characteristics, *Drawdown, Pumping, Observation wells, Groundwater recharge, Water level fluctuations, Hydrographs.

During 1977 and 1978, water levels in the Floridan aquifer throughout most of north and central peninsular Florida rose 1 to 3 feet, based on water levels measured in 380 wells selected from a network of about 5,000 observation wells for which measurements are in the files of the U.S. Geological Survey. Hydrographs of 51 wells are presented which show long-term trends of ground-water levels in selected areas of Florida. In west-central Polk County, an area of notable pumping, levels in the Floridan and other aquifers rose in response to decreased pumping of ground water for industrial use. In north Florida, levels rose from 1 to about 4 feet in Suwannee and Hamilton Counties. In northwest Florida, levels in the sand-and-gravel aquifer rose from less than 1 foot to 5 feet. Most widespread declines in ground-water levels in northwest Florida occurred in the Tallahassee area where levels declined from 1 to nearly 5 feet. (USGS)
W81-00346

THE SURFICIAL AQUIFER AT THE U.S. NAVAL STATION NEAR MAYPORT, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
B. J. Franks.
Denver, CO. 80225. Paper copy $2.00, microfiche $3.50. Geological Survey Open-File Report 80-765, 1980. 13 p, 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Unconsolidated aquifers, *Aquifer characteristics, *Groundwater, *Water quality, *Shallow wells, *Florida, Potential water supply, Water table, Water wells, Test wells, Brackish water, Transmissivity, Water yield, Water utilization, Water chemistry, Heat exchangers, Hydrogeology, Evaluation, *Duval County(FL).

The surficial aquifer at the U.S. Naval Station near Mayport, Florida, consists of about 70 feet of unconsolidated sand, shell, and clay. The principal water-bearing zone is a shell bed 35 to 55 feet below land surface. The aquifer is unconfined, and the water table was about 4 feet below land surface during the investigation (spring 1979). Aquifer tests indicate a transmissivity for the aquifer of approximately 2,400 feet squared per day. Water in the upper 40 feet of the aquifer is fresh, but becomes increasingly brackish with depth. Use of water from the surficial aquifer is limited because of low yields and poor water quality. Feasibility of injection of return cooling water into the surficial aquifer is limited by the shallow water table. (USGS)
W81-00349

POTENTIOMETRIC MAP OF THE COFFEE SAND AQUIFER IN NORTHEASTERN MISSISSIPPI, OCTOBER AND NOVEMBER 1978,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Wasson.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225, Paper copy $2.50, microfiche $0.50. Geological Survey Open-File Report 79-1587 (WRI), 1980. 1 Sheet, 7 Ref.

Descriptors: *Maps, *Potentiometric level, *Aquifers, *Groundwater, *Mississippi, Water resources, Natural recharge, Observation wells, Water level fluctuations, Hydrogeology, Hydrographs, *Coffee Sand aquifer(MS).

This potentiometric map of the Coffee Sand aquifer in northeastern Mississippi is the fourth in a series of maps, prepared by the U.S. Geological Survey in cooperation with the Mississippi Department of Natural Resources, Bureau of Land and Water Resources, delineating the potentiometric surfaces of the major aquifers in Mississippi. In the outcrop areas the potentiometric surface is strongly affected by recharge from precipitation, topography, and drainage of the aquifer by streams. The potentiometric surface slopes generally to the west away from the area of outcrop and is mildly affected by moderate ground-water withdrawals by wells in Tippah and Union County. Historically, water levels in or near the outcrop of the Coffee Sand have shown little or no long-term changes as shown by a hydrograph of one well in Alcorn County. In the downdip part of the aquifer water-level declines of 2 feet per year are common. (USGS)
W81-00356

POTENTIOMETRIC MAP OF THE EUTAW-MC SHAN AQUIFER IN NORTHEASTERN MISSISSIPPI, SEPTEMBER, OCTOBER, AND NOVEMBER 1978,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Wasson.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225. Paper copy $2.50, microfiche $0.50. Geological Survey Open-File Repot 79-1584 (WRI), 1980. 1 Sheet, 9 Ref.

Descriptors: *Maps, *Potentiometric level, *Aquifers, *Groundwater, *Mississippi, Water resources, Natural recharge, Observation wells, Water level fluctuations, Hydrogeology, Hydrographs, *Eutah-McShan aquifer(MS).

This potentiometric map of the Eutaw-McShan aquifer in northeastern Mississippi is the third in a series of maps, prepared by the U.S. Geological Survey in cooperation with the Mississippi Department of Natural Resources, Bureau of Land and Water Resources, delineating the potentiometric surfaces of the major aquifers in Mississippi. From its outcrop area the Eutaw-McShan aquifer dips about 30 feet per mile to the west and southwest. Thickness of the aquifer commonly is between 200 and 300 feet in most of the area, and commonly about one-half this thickness consists of sand. In the outcrop area the potentiometric surface is strongly affected by recharge from precipitation, topography, and drainage of the aquifer by streams. The potentiometric surface of the aquifer slopes generally to the west away from the area of outcrop and it is strongly affected by large groundwater withdrawals at or near Tupelo, Aberdeen, and West Point. Historically, water levels in or near the outcrop of the Eutaw-McShan aquifer have shown little or no long-term changes. Withdrawals of water by wells from the downdip area have caused long-term water-level declines of 1 to 2 feet per year in much of the confined part of the aquifer. Water-level declines during recent years in several observation wells in Lee County ranged from 2 to 9 feet per year. One hydrograph in Clay County that is near the center of the depression in the potentiometric surface at West Point shows about 5 feet per year of water-level decline since 1972. (USGS)
W81-00357

POTENTIOMETRIC MAP OF THE RIPLEY AQUIFER IN NORTHEASTERN MISSISSIPPI, OCTOBER AND NOVEMBER 1978,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Wasson.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225, Paper copy $2.50, microfiche $0.50. Geological Survey Open-File Report 79-1585 (WRI), 1980. 1 Sheet, 5 Ref.

Descriptors: *Maps, *Potentiometric level, *Aquifers, *Groundwater, *Mississippi, Water resources, Natural recharge, Observation wells, Water level fluctuations, Hydrogeology, Hydrographs, *Ripley aquifer(MS).

This potentiometric map of the Ripley aquifer in northeastern Mississippi is the fifth in a series of maps, prepared by the U.S. Geological Survey in cooperation with the Mississippi Department of Natural Resources, Bureau of Land and Water Resources, delineating the potentiometric surfaces of the major aquifers in Mississippi. In the outcrop area of the Ripley aquifer the potentiometric surface is strongly affected by recharge from precipitation, by topography, and by drainage of the aquifer by streams. The potentiometric surface slopes generally to the west away from the area of outcrop and is mildly affected by pumpage from wells and by discharge of flowing wells in the valleys. Historically, water levels in or near the outcrop have shown little or no long-term changes. (USGS)
W81-00358

POTENTIOMETRIC MAP OF THE GORDO AQUIFER IN NORTHEASTERN MISSISSIPPI, SEPTEMBER, OCTOBER, AND NOVEMBER 1978,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Wasson.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225. Paper copy $2.50, microfiche $0.50. Geological Survey Open-File Report 79-1586 (WRI), 1980. 1 Sheet, 9 Ref.

Descriptors: *Maps, *Potentiometric level, *Aquifers, *Groundwater, *Mississippi, Water resources, Natural recharge, Observation wells, Water level fluctuations, Hydrogeology, Hydrographs, *Gordo aquifer(MS).

This potentiometric map of the Gordo aquifer in northeastern Mississippi is the second in a series of maps, prepared by the U.S. Geological Survey in cooperation with the Mississippi Department of Natural Resources, Bureau of Land and Water Resources, delineating the potentiometric surfaces of the major aquifers in Mississippi. The potentiometric surface of the Gordo aquifer slopes generally to the west away from the outcrop area and it is depressed generally by large ground-water withdrawals in the Tupelo and Columbus areas. Historically, water levels in or near the outcrop of the Gordo aquifer have shown little or no long-term changes. Heavy withdrawals from the downdip area have caused long-term water-level declines of 1 to 2 feet per year in much of the confined part of the aquifer. Water-level decline in one observation well in Tupelo has averaged about 5 feet per year since 1966. (USGS)
W81-00359

2G. Water In Soils

FORESTED WETLANDS IN EASTERN CONNECTICUT: THEIR TRANSITION ZONES AND DELINEATION,
GCA Corp., Bedford, MA. GCA Technology Div.
For primary bibliographic entry see Field 2I.
W81-00272

AN INSTRUMENTED LYSIMETER SYSTEM FOR MONITORING SALT AND WATER MOVEMENT,
Science and Education Administration. Kimberly,

ID. Snake River Conservation Research Center.
C. W. Robbins, and L. S. Willardson.
Transactions of the American Society of Agricultural Engineers, Vol 23, No 1, p 109-111, January-February 1980. 4 Fig, 7 Ref. OWRT-B-148-UTAH(2), 14-34-0001-7195.

Descriptors: *Lysimeters, *Equipment, *Soil water movement, *Salinity, Laboratory equipment, Instrumentation, Design, Construction, Salts, Weight, Conductivity, Soils, Soil science.

A lysimeter system was described that consists of four continuously weighing lysimeters mounted on a portable platform. The lysimeters, made from low pressure PVC irrigation pipe (1.18 m deep by 0.31 m dia), are placed on a hydraulic weighing system that consists of either a water-filled rubber pillow or an automotive innertube connected to a water column. The sensitivity of the weighing system is 0.1 kg or an equivalent water depth of 1.4 mm. One-bar ceramic cups, placed in the center of the lysimeters at 0.25, 0.50, and 0.75 m from the soil surface, are connected to the outside for soil solution sampling. Eight small bolts symmetrically located around the lysimeter at the same depths as the ceramic cups serve as 'four probe' contacts for electrical conductivity measurements. The cost of each set of four lysimeters in 1978 was about $400. (Sims-ISWS)
W81-00273

THE EFFECT OF NITRATE ON NITROUS OXIDE REDUCTION IN ORGANIC SOILS AND SEDIMENTS,
Agricultural Research and Education Center, Belle Glade, FL.
For primary bibliographic entry see Field 2K.
W81-00311

INFLUENCE OF SIZE OF GYPSUM PARTICLES ON THE HYDRAULIC CONDUCTIVITY OF SOILS,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
R. Keren, J. F. Kreit, and I. Shainberg.
Soil Science, Vol 130, No 3, p 113-117, September, 1980. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Hydraulic conductivity, *Gypsum, *Soil types, Particle size, Loam, Foreign research, Calcium compounds, Hydrology, Pores, Soil physical properties, Leaching.

The influence of gypsum fragments and content on the hydraulic conductivity of soils before the gypsum has dissolved was studied in a loamy soil and a sandy loam soil, both from the coastal plain of Israel. The soils were mixed with gypsum to bring the gypsum content to 1, 5, or 10% of the sample. Two ranges of particle sizes were used: less than 44 micrometers or 0.25-1.0 mm in diameter. Soils were packed into columns, covered with quartz sand, flushed with carbon dioxide and subsequently wetted from the top by flooding the surface with 0.0025 M CaC12 solution in air-free water. The hydraulic conductivity of the soils increased with the dissolution of gypsum from the column. The initial relative hydraulic conductivity in both soils containing 5 and 10% gypsum decreased to 35 and 20%, respectively. The loam soil was more sensitive to gypsum content. Large pores in the sandy loam soil more easily accommodated the gypsum fragments without a drop in the hydraulic conductivity. As the content of gypsum increased, the difference between the soils disappeared. When mixed with the larger fragments of gypsum, the hydraulic conductivity of both soils was almost unaffected, suggesting that the effect of the gypsum particle is mainly physical and the decrease in initial hydraulic conductivity was due to plugging of the soil pores with gypsum particles. (Baker-FRC)
W81-00413

SALINITY EFFECTS ON HYDRAULIC PROPERTIES OF SOILS,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
C. S. Park, and G. A. O'Connor.
Soil Science, Vol 130, No 3, p 167-174, September, 1980. 6 Fig, 3 Tab, 15 Ref.

Descriptors: *Groundwater movement, *Salinity, *Hydraulic conductivity, *Soil texture, Permeability, Porosity, Soil physical properties, Sands, Clays, Rain water, Water types, Saturated flow, Hydrology, Physical properties.

Four soils ranging from sand to clay were used to study saturated hydraulic conductivity (HC) and infilitration rates with five saline-sodic waters representative of the saline groundwaters in New Mexico. The waters contained dissolved solids in amounts ranging from 1,250 to 15,000 mg/liter. SAR values ranged from 16 to 57. Water quality did not significantly affect the saturated soil HC as long as these waters remained the sole source of irrigation water. Swelling was kept to a minimum so long as the electrolyte concentration remained above the threshold value. The passage of 1 pore volume of high quality water, representative of rain water, through the test soils caused a significant reduction in saturated HC. In Sheppard sand, HC values at 1 pore volume of drainage were reduced by 25-35%. Very sandy soils were the least affected. As this decrease was not reversible, it was thought that dispersion, rather than swelling, was responsible for the decreased HC. Swelling was an important mechanism only in clay soils. It was concluded that, where saline-sodic water is the dominant source of irrigation and is supplemented by rains, all combinations of saline-sodic water could be used on very sandy soils, while no saline-sodic waters should be used on fine-textured soils, and only slightly sodic waters would be successful on medium-textured soils. (Baker-FRC)
W81-00415

2H. Lakes

OCCURRENCE AND REGULATORY ROLE OF CYCLIC ADENOSINE MONOPHOSPHATE IN THE NUTRIENT DYNAMICS OF CONTROLLED AND NATURAL COMMUNITIES OF LAKES,
Michigan State Univ., Hickory Corners. W. K Kellogg Gull Lake Labs.
R. G. Wetzel, and D. A. Francko.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120586. Price codes: A04 in paper copy, A01 in microfiche Institute of Water Research, Michigan State University, Project Completion Report. October, 1980. 51 p, 16 Fig, 9 Tab. OWRT A-103-MICH(1), 14-34-0001-9024, 0124.

Descriptors: *Algae, Macrophytes, Cyanophyta, Nitrogen, *Nutrients, *Phosphorus, Nutrient limitations, *Lakes, Phytoplankton, Alkaline phosphatase activity, Chlorophyll, Phosphates, *Adenosine monophosphate.

Cyclic adenosine 3':5'-monophosphate (cAMP) was found in both cellular and dissolved forms in cultures of several species of green and blue-green algae. Quantities of both cellular and dissolved cAMP varied interspecifically under similar culture conditions and intraspecifically under differing culture conditions and at different stages of cell growth. Similar quantities of tissue and filtrate cAMP were found in several species of aquatic vascular plants and aquatic bacteria. In the epilimnia and littoral zones of two trophically dissimilar aquatic systems, cAMP was found in both particulate-associated and dissolved phases in lakewater samples. Both cAMP fractions varied greatly in concentration both seasonally and between the lakes. Particulate cAMP levels were largely due to algal cAMP content, while dissolved cAMP in epilimnetic and littoral lakewater samples resulted from combined release by algae, aquatic macrophytes, bacteria and other autochthonous sources. Most of the total cAMP was found in the dissolved phase during all times of the year. Cellular cAMP levels in the blue-green alga Anabaena flos-aquae were enhanced upon inoculation into N-free, but not P-free media. Cellular cAMP levels also increased upon inoculation into fresh media containing non-limiting nutrient concentrations. Cellular cAMP levels in Anabaena were exponentially correlated with 14C-bicarbonate uptake. In oligotrophic Lawrence Lake, particulate cAMP levels were linearly correlated to 14C-primary productivity rates in the epilimnion on a seasonal basis. In Lawrence Lake and hypereutrophic Wintergreen Lake, particulate cAMP levels in certain phytoplankton associations were linearly correlated to alkaline phosphatase specific activity and chlorophyll a content. Cyclical changes in particulate and dissolved cAMP levels corresponded to changes in phytoplankton abundance and community composition
W81-00266

STRATIFIED BIDIRECTIONAL SEEPAGE FLOW THROUGH AN EARTHEN EMBANKMENT,
Lowe (Roger) Associates, Inc., Bellevue, WA.
J. T. Cameron, C. T. Kincaid, and G. Z. Watters
In: Finite Elements in Water Resources, Volume 1; Preprints of the Third International Conference (2 Vol), Mississippi University, Oxford, May 19-23m 1980. p 2.127-2.136, 1980. 10 Fig, 1 Tab, 4 Ref. Science and Education Administration, New Orleans, Louisiana. OWRT B-139-UTAH(9), 14-34-0001-7191.

Descriptors: *Seepage, *Embankments, *Great Salt Lake, *Model studies, Saline water-freshwater interfaces, Mathematical models, Analytical techniques, Groundwater movement, Porous media, Lakes, Salinity, Density, Pressure, Hydraulic conductivity, Interfaces, Stratification, Stratified flow, Causeways.

From the early years of this century until 1959, Great Salt Lake West of Promontory was spanned by the Southern Pacific Railroad on a wooden trestle. For reasons of maintenance and vulnerability to fire, an earthen causeway was constructed replacing the 12-mile long trestle. Originally designed to permit a free exchange of salt brines between the northern and southern bodies of water, the embankment presently restricts the flows. Since freshwater recharge to this terminal lake predominantly enters the southern arm, an elevation gradient drives a northward flow through the upper zone of the causeway. The greater salinity concentrations which have evolved in the northern arm have given rise to a density gradient which drives a southward flow through the lower zone of the causeway embankment. The objective of this study was the numerical simulation of this stratified bidirectional seepage flow through the earthen embankment. Specifically, a two-dimensional finite element model of stratified flow in porous media was developed. Discharges, free surface and interface locations were predicted as functions of fluid densities and lake surface and interface elevations. (See also W80-06858) (Sims-ISWS)
W81-00270

LAKE SAMMAMISH RESPONSE TO WASTEWATER FIVERSION AND INCREASING URBAN RUNOFF,
Washington Univ., Seattle. Dept. of Civil Engineering.
E. B Welch, C. A. Rock, R. C. Howe, and M. A Perkins.
Water Research, Vol 14, No 7, p 821-828, 1980. 3 Fig, 2 Tab, 19 Ref. OWRT-B-068-WASH(2). EPA R-800512.

Descriptors: *Lakes, *Water pollution sources, Watersheds(Basins), *Washington, Storm runoff, Urban runoff, Waste water disposal, *Phosphorus, Diversion, On-site investigations, Data collctions, Analysis, *Phytoplankton, Water quality, Sampling, Algae, Cyanophytes, *Lake Sammamish(WA)

Lake Sammamish has shown a decrease in its mean annual concentration of phosphorus following diversion of about one-third of the external loading in 1968. During 1971-1975 the P concentration averaged 27 micrograms/l, in contrast to the prediversion (1964-1966) concentration of 33 micrograms/1, and may be equilibrating near the predicted steady-state concentration of 22 micrograms/l. Neither phytoplankton biomass or Secchi

visibility has changed following diversion; however, the blue-green component of the phytoplankton decreased by nearly 50%. The failure of biomass and visibility to improve is probably a result of similar pre- and postdiverson winter-spring epilimnetic P concentrations. The marked reduction in P since diversion occurred during and prior to fall overturn and may have represented a supply or P for later summer early fall blue-green algal populations that declined after diversion. Runoff from a rapidly developing westside portion (18%) of the watershed is contributing substantially to P loading of the lake. Development to a density of about ten dwellings/ha has increased loadin possibly on the order of 14%. Future development of the eastside portion (26% of watershed) may increase loading by 20% and be equivalent to nearly one-half of the P previously diverted in 1968. (Humphreys-ISWS)
W81-00274

ENHANCEMENT OF RELEASE WATER QUALITY BY LOCALIZED MIXING LAKE OKATIBBEE, MS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
S. C. Wilhelms.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 97-100 (1979) 4 Fig, 1 Tab.

Descriptors: *Stratification, *Water quality, *Garton pump, *Discharge(Water), Dissolved oxygen, Hypolimnion, Epilimnion, Thermal stratification, Mixing, Destratification, Turbulence, Pumping, Water circulation.

A low-energy mechanical pump, the Garton pump, was used to demonstrate that localized mixing near a fixed low-level outlet will enhance the quality of low flow releases by mixing water from the epilimnion with water from the hypolimnion. Thermal stratification can result in a hypolimnion with zero dissolved oxygen and high levels of hydrogen sulfide, iron, and manganese. Release of such low quality water without mixing can result in poor water quality downstream,Lake Okatibbee, near Meridian, Mississippi, was used for the demonstration. It is a shallow lake with a fixed low-level intake, a horseshoe-shaped conduit, and a stilling basin. The Garton pump was attached to the upstream face of intake structure to pump water from the surface toward the bottom. A Hydrolab Surveyor Model 6D Water Quality Analyzer and a Yellow Springs Instrument (YSI) D. O.-Temperature meter were used along with titration to take water quality measurements. Results show a definite improvement in released water quality where the fan is used. Approximately 50% of the outlet fow was estimated to be epilimnion water. Important design factors include the relationship between discharge rate and release rate, pump thrust, and pump discharge penetration depth. (See also W81-00290) (Seigler-IPA)
W81-00309

A TROPHIC CLASSIFICATION OF MINNESOTA LAKES BASED ON LAKE SEDIMENTS,
Minnesota Univ., Minneapolis. Limnological Research Center.
H. E. Wright, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124141, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, July, 1980. 20 p, 4 Fig, 1 Tab, 22 Ref. OWRT-B-128-MINN(1), 14-34-0001-7164.

Descriptors: *Minnesota, *Lake morphology, *Lake sediments, *Diatoms, *Bioindicators, Correlation analysis, Sampling bodies of water, Lakes, Lake beds, Microorganisms, Aquatic life, Microbiology, Water sampling, Assay, Statistical methods, Chemical analysis, Ecological distribution, Sediment, Diatomaceous earth, Bottom sediments, Water chemistry, Eutrophication.

The lakes sampled were selected to be representative of the wide variety of Minnesota lake types. Sediments were sampled in each of 105 lakes in the deepest water. The surface sediment samples were analyzed for diatoms, and water samples from the same lakes were chemically analyzed. Correlation between the two series by cluster analysis provided the ecological basis for the use of diatom assemblages to classify lakes. Deep oligotrophic lakes were characterized by Cyclotella comta; dilute acid lakes were characterized by Melosira distans, Meloshira italica, Tabellaria fenestrata, Cyclotella stelligera, and Cyclotella glomerata; and highly entrophic lakes were characterized by Stephanodiscus hantzschii. Diatom analysis of lake sediment cores could then be used to reconstruct past lake conditions, and thus evaluate the changes in lake trophic status as a result of pollution and changes induced by natural climatic and hydrologic factors. The results showed that Stephanodiscus hantzschii was a consistent indicator of cultural eutrophication. (Zielinski-IPA)
W81-00322

DIFFERENTIAL C02 AND 02 BENTHIC COMMUNITY METABOLISM IN A SOFT-WATER LAKE,
Connecticut Univ., Storrs. Biological Sciences Group.
P. H. Rich.
Journal of the Fisheries Research Board of Canada, Vol 36, No 11, p 1377-1389, 1979. 8 Fig, 5 Tab, 51 Ref. OWRT-A-071-CONN(4), 14-31-0007-6007.

Descriptors: *Respiratory quotients, *Carbon dioxide, *Dissolved oxygen, Biochemical oxygen demand, Oxygen demand, Photosynthesis, Cyanophyta, Anaerobic conditions, *Lakes, Aerobic conditions, Stratification, Metabolism, Respiration, Connecticut, Dunham Pond(CT).

Respiratory quotients (RQ = C02 released/02 taken up) were examined for Dunham Pond, a small, softwater lake in the eastern Paleozoic highlands of Connecticut. Samples were taken weekly or every two weeks from January 1973 to April 1976 at stations located centrally, at the inlet streams, and at the outlet. Light meaurements were made with a cadmium sulfide cell and Secchi disk. Measurements of temperature, conductivity, dissolved oxygen, dissolved carbon dioxide, and chemcal oxygen demand were also made. Surface sediment samples were taken at 3.5 m with a free-fall core sampler. Results show that less than 1% surface light exists below 2.5 m due to high concentrations of dissolved and colloidal humic organic matter. During the summer, C02 accumulation was found to be greater than 02 removal in the hypolimnion. During winter stratification this condition exists for the whole lake. C02 uptake was fond in situ in sediment surface incubations at 3.5 m. This was associated with the anaerobic photosynthesis of an epipelic mat of blue-green algae. The RQ of the lake community was greater (.85) than expected due to the mixed community of aerobes and anaerobes. The higher than expected RQ describes the amount of metabolism for which oxygen has not yet been the terminal electron acceptor. (Seigler-IPA)
W81-00341

HYDROLOGIC BUDGET FOR EAGLE LAKE NEAR WILLMAR, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
C. F. Myette.
Available from OFSS, Box 25425, Fed. Ctr., Denver, CO 80225, paper copy $2.00, microfiche $3.50. Geological Survey Open-File Report 80-163, 1980. 13 p, 4 Fig, 1 Tab, 11 Ref.

Descriptors: *Hydrologic budget, *Lakes, *Minnesota, *Eutrofication, *Hydrologic equation, Darcys law, Streamflow, Flow nets, Hydrogeology, Glacial drift, *Eagle Lake (MN), Hawk Creek(MN), Willmar(MN).

Eagle Lake occupies 890 acres of a 9,000-acre watershed in central Minnesota. Because of its proximity to Willmar, many homes and summer cabins have been built around the lake. Presently (1978), the shore is more than 90 percent developed. One effect of this development is accelerated eutrophication, most commonly shown by algae blooms. An annual hydrologic budget for Eagle Lake was prepared for the 1978 water year in support of a nutrient study prepared by the University of Minnesota at Morris. Results show that the amount of water that flowed through Eagle Lake in the 1978 water year was 6,670 acre-feet. Inflow to the lake was 45 percent surface water, 22 percent ground water, and 33 percent precipitation. Outflow was 73 prcent surface water, 25 percent evaporation, and slightly greater than 2 percent net change in lake storage. Estimates for the ground-water component were derived both as a residual in the hydrologic-budget equation and by flow-net analyses. The residual value of 1,450 acre-feet compared favorably with the flow-net value of 1,400 acre-feet. (USGS)
W81-00365

VARIABILITY IN MICROBIOLOGICAL DATA FROM A STRATIFIED EUTROPHIC LAKE,
Freshwater Biological Association, Ambleside (England).
J. G. Jones, and B. M. Simon.
Journal of Applied Bacteriology, Vol 49, No 1, p 127-135, August, 1980. 6 Fig, 1 Tab, 23 Ref.

Descriptors: *Microbiology, *Lakes, *Eutrophication, Bacteria, Chlorophyll, Hypolimnion, Limnology, Thermal stratification, Oxygen, Lentic environment, Sediments, Sampling, Analytical techniques, Water quality, Lake stages, Seasonal.

The degree of variability in direct bacterial counts, electron transport system activity, ATP levels, chlorophyll a concentration, and chemiluminescence was studied in a stratified eutrophic lake. The Blelham Tarn, Cumbria (England) is 0.67 km long and averages 14.5 m in depth. In summer, it becomes thermally stratified, and the hypolimnion is deoxygenated, usually to within 6 m of the surface. In August, sediment and water column samples were taken at seven points along a line transecting the tarn, and heterogeneity in the horizontal and vertical dimensions was examined. The scale of variability was compared with intra- and inter-sample errors. For samples taken at a single site, the coefficient of variation was often as great as the variability found between sites in a transect across the lake, especially for sediments. Seasonal variability in sediment activity was comparable to coefficients of 30% and greater reported for oxygen uptake in previous experiments. It has been suggested that thermal stratification and deoxygenation of the hypolimnion may affect sediment microbiota to an even greater degree than that in the water column. The results of this study should indicate the number of sampling as needed to achieve a given degree of precision when examining microbiological parameters of a stratified lentic system. (Geiger-FRC)
W81-00405

PHYSIOLOGICAL ADAPATATIONS IN RESPONSE TO ENVIRONMENTAL STRESS DURING AN N2-FIXING ANABAENA BLOOM,
North Carolina Univ., at Morehead City. Inst. of Marine Sciences.
P. E. Keller, and H. W. Paerl.
Applied and Environmental Microbiology, Vol 40, No 3, p 587-595, September, 1980. 4 Fig, 4 Tab, 46 Ref.

Descriptors: *Anabaena, *Lakes, *Eutrophication, *Nitrogen fixation, Adaptation, Algae, Aquatic plants, Carbon dioxide, Diurnal, Carbon fixation, Photosynthesis, Oxygen demand, Radiation, Dissolved oxygen, Epilimnion, Leutic environment, Phytoplankton.

The heterocystous blue-green algae, Anabaena spiroides has been shown to maintain prolonged and intense biomass production in the epilimnion of a eutrophic lentic environment (Thompson Lake, Ontario) that caused photooxidative death to many phytoplankton. Chlorophyll-a was protected from photooxidation by increased carotenoid production in A. spiroides, which retarded catalysis of other cell photooxidative reactions. Maximum use of photosynthetic active radiation (PAR) was achieved by temporally separating carbon dioxide and elemental nitrogen fixation. Carbon dioxide fixation was at a maximum in the morning before the afternoon buildup of dissolved oxygen, while

elemental nitrogen fixation, being less oxygen sensitive, peaked during the afternoon, after maximum incident PAR levels were reached. The advantages of the diurnal partitioning of carbon and elemental nitrogen fixation are the minimization of competition for reductant-generating compounds and the ample supply of carbon skeletons to accept fixed ammonia. Thus, survival of Anabaena in eutrophic waters was attributed to physiological factors, namely the utilization of radiant energy for reproduction and the ability to dominate surface waters by shading deeper phytoplankton during summer blooms. (Geiger-FRC)
W81-00449

OXYGEN EXCHANGE BETWEEN A 'MODEL' POND AND THE ATMOSPHERE,
Science and Education Administration, Durant, Southern Plains Watershed and Water Quality Lab.
For primary bibliographic entry see Field 2D.
W81-00495

2I. Water In Plants

FORESTED WETLANDS IN EASTERN CONNECTICUT: THEIR TRANSITION ZONES AND DELINEATION,
GCA Corp., Bedford, MA. GCA Technology Div.
P. H. Anderson, M. W. Lefor, and W. C. Kennard.
Water Resources Bulletin, Vo 16, No 2, p 248-255, April 1980. 1 Fig, 4 Tab, 17 Ref. OWRT A-058-CONN(4), 14-31-0001-4007.

Descriptors: *Wetlands, *Forests, *Vegetation, *Soil water, *Connecticut, On-site investigations, On-site data collections, Data processing, Mathematical models, Analytical techniques, Moisture content, Soils, Soil moisture, Soil chemistry, Soil science, Freshwater wetlands, Wetland delineation, Forested wetlands, Discriminant analysis.

The delineation of inland wetlands requires close field examination of the biological and physical gradients (transition zones) between wetlands and bordering uplands. As part of a study on the detection and delineation of inland wetlands in eastern Connecticut by remote sensing techniques, this effort was designed to investigate vegetation distribution and composition and selected physical and chemical properties of the soils of wetland to upland transition zones in deciduous wetland forests. Field research was conducted during the growing season of 1975 within a test area consisting of the 45-sq mi Town of Mansfield, Connecticut. Changes in vegetation composition and structure, soil pH, and soil water content were determined along line transects extended over wetland to upland transition zones. Differences in soil pH occurred along the transects but were of such magnitude that they probably have little impact on plant distribution. There were significant changes in soil water content along the wetland to upland gradients. Discriminant analysis applied to statistical 'index of abundance' data describing vegetation distribution among the various zones (wetland, transition, upland) showed which plant species best distinguish wetlands from uplands. Of the criteria studied, vegetation composition and distribution, soil water content, and relief are the most useful criteria for delineating deciduous wetland forests. (Sims-ISWS)
W81-00272

WATER CONSERVATION THROUGH PLANT BREEDING - ALFALFA,
New Mexico State Univ., Las Cruces.
M. Wilson, and B. Melton.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 105-108. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *Alfalfa, *Plant breeding, *Genetics, *Moisture availability, *Agriculture, *Planting management, Water requirements, Phenology, Irrigation systems, Crop response, Adsorption, Crop production, Phylogeny.

The need for water conservation has forced plant breeders to reevaluate management systems which utilize large quantities of water in an effort to obtain maximum production. Alfalfa normally requires large amounts of water for optimum production, however, many studies have commented on its drought resistance. This illustrates the possibilities of genetic variability that may occur as a result of diverse moisture conditions. Significant differences were obtained among twenty-four alfalfa varieties evaluated under 16, 48 and 80-acre-inch per year irrigation regimes. These results suggest that by genetic manipulation, it may be possible to devlop varieties which will perform better than existing varieties under limited moisture conditions. Further evidence of useful plant variation was obtained by comparing plants selected from differing screening procedures. Field and greenhouse tests have been established to evaluate the extent to which these results will be transmitted to the next generations. (Vernale-Omniplan)
W81-00396

2J. Erosion and Sedimentation

GEOLOGIC AND GEOMORPHIC ASPECTS OF STREAMBANK EROSION IN THE YAZOO HILL STREAMS,
Army Engineer District, Vicksburg, MS. Potamology Section.
R. E. Rentschler.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 43-48, (1979) 21 Fig.

Descriptors: *Mississippi, *Yazoo Basin, *Erosion control, *Bank erosion, Bank stability, Degradation(Stream), Stream erosion, Erosion rates, Stream stabilization, Stream improvement, Geologic formations, Rocks, Cutoffs, Channel improvement.

A series of grade control structures are being constructed and studied on several Yazoo Hill Streams in an attempt to develop methods for controlling the serious erosion in the area. For the past 150 years the Yazoo Basin in Mississippi has suffered an accelerated rate of erosion due to early agricultural practices. The main factor in stream bank erosion in the area is bed degradation, much of which was caused by man straightening, channelizing, or in some way altering the stream. Channel straightening and cutoffs have severely damaged the upper reaches of South Fork Tillatoba Creek. The construction of a cutoff changed the stream's natural slope, alternate bar sequence, sediment movement, and channel geometry. A series of aerial photographs illustrate this example. In general, the hill streams of the Yazoo area have a definite lack of stabilizing geologic formations within their channels. Bedrock in the channels is predominantly a poorly cemented iron sandstone. Bank erosion is directly related to the resistance of the materials in the bed and the banks. Prior to any form of stream improvement, the composition of the bed should be studied as a key to future stream conditions. (See also W81-00290) (Seigler-IPA)
W81-00299

SEDIMENT SOURCES AND YIELDS FROM UPLAND WATERSHEDS IN NORTH MISSISSIPPI,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
F. E. Dendy, S. J. Ursic, and A. J. Bowie.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 49-54, (1979) 6 Fig, 4 Tab, 12 Ref.

Descriptors: *Mississippi, *Sediment yield, *Watersheds(Basins), Sediment load, Land use, Sediment transport, Erosion, Gullies, Rainfall, Runoff, Forests, Pastures, Soil erosion, Mathematical studies.

Nineteen small unit source watersheds and five large mixed-cover watersheds located in the Pigeon Roost Creek basin in Marshall County, Mississippi, were used to show that sediment yields from small unit source watersheds can be used to predict sediment yields from the large watersheds. Of the small watersheds, one was in pasture, two in cultivation, and sixteen in abandoned fields and forest. The large, mixed-cover watersheds ranged in size from 1000 to 22,800 acres with 20 to 25% cultivated, 40 to 50% pasture or idle, and 30 to 40% forest. Annual rainfall, runoff, and sediment yields for the small watersheds are summarized. Large differences in runoff among land uses are evident. Annual sediment yields in the small watersheds ranged from a few pounds per acre from forest land to 43 tons per acre for cultivated land. Annual runoff-sediment relationships from the small watersheds were used to compute sediment yields for the five large watersheds. Computed yields and measured yields compared favorably. In the large watersheds, cultivated land, gullies, and stream channels composed 25% of the area and contributed 95% of the sediment yield. Pasture-idle land with 38 to 50% of the total area contributed 5% of the sediment yield and forest land, 25 to 43% of the area, contributed only 0.2% of the sediment yield. (See also W81-00290) (Seigler-IPA)
W81-00300

RUNOFF COMPOSITION OF SOYBEAN MANAGEMENT SYSTEMS ON LEEPER CLAY LOAM SOIL,
Science and Education Administration, Oxford, MD. Sedimentation Lab.
M. J. M. Romkens, J. Y. Wand, F. D. Whisler, N. W. Buehring, and J. K. Young.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 55-59, (1979) 3 Fig, 6 Tab, 9 Ref.

Descriptors: *Rainfall-runoff relationships, *Sediment load, *Sediment transport, Soil erosion, Surface runoff, Loam, Soybeans, Wheat, Agriculture, Phosphorus, Nitrogen, Clays, Sediment yield, Nutrient removal.

Soil loss and the chemical composition of runoff were studied for various tillage management systems on bottomland during simulated rainstorms. Soil erosion and runoff have traditionally been studied for sloping uplands but concern about the transport of agricultural chemicals in low-land areas such as soybean bottomlands is growing. One tillage management system studied used double cropping with soybeans and wheat. The other system, minimum tillage, was identical except that no wheat was planted. A fallow system was also tested. Two 60-minute simulated rainstorms were applied. Between 20 and 25 'grab' samples were collected per plot for each storm. Samples were analyzed in the laboratory for sediment concentration, dissolved solids, and the nitrogen, phosphorus, and potassium content of the water and/or sediment. Chemical or sediment concentrations were integrated over the hydrograph or sedigraph to determine total losses. Results show that soil loss from the minimum tillage was substantially less than from the fallow system. Nutrient loss from both the double cropping and minimum tillage systems was substantial. The clay content of sediment was found to increase as sediment yield decreased. (See also W81-00290) (Seigler-IPA)
W81-00301

SOME APPLICATIONS OF THE CONCEPT OF GEOMORPHIC THRESHOLDS,
S. A. Schumm.
In: Thresholds in Geomorohology, p 473-485, 1980. 7 Fig 27 Ref. Ge, 27 Ref. George Allen and Unwin, London. OWRT-B-150-COLO(3), 14-34-0001-7143.

Descriptors: *Geomorphology, *Thresholds, *Erosion, *Deposition(Sediments), Terraces(Geologic), Gullies, Slopes, Glaciers, Hydrogeology, Forecasting, Land farming, Meanders, Sedimentology, Cutoffs, Arroyos

The concept of geomorphic thresholds, thresholds of landform stability that are exceeded either by progressive change of the landform or by change in an external variable, can be applied to both

geomorphic and land management problems to identify those conditions at which a landform is incipiently unstable. If the threshold is crossed due to internal influences, the threshold is intrinsic. If the threshold is crossed due to a change in an external variable, the threshold is external. Threshold an episodic erosion can be used to explain anomalous erosion and deposition changes whether as a result of man's activities or as a normal part of landscape evolution. To advise engineers and land manager's a geomorphologist must identify the type of geomorphic threshold that is causing a change such as fan-head trenching, arroyo cutting, gully development, stream capture, pattern change, and meander cutoff. Rivers near the threshold of pattern change, such as the Chippea River in Wisconsin, can be identified to aid in planning. Also, the geomorphologist considers the fact that erosion or deposition are not always progressive. The crossing of thresholds in high-relief areas may produce episodic erosion or deposition. (Seigler-IPA)
W81-00342

A FIELD CALIBRATION OF THE SEDIMENT-TRAPPING CHARACTERISTICS OF THE HELLEY -SMITH BEDLOAD SAMPLER,
Geological Survey, Lakewood, Co. Water Resources Div.
W. W. Emmett.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.25. Geological Survey Professional Paper 1139, 1980. 44 p, 48 Fig, 13 Tab, 13 Ref.

Descriptors: *Bed load, *Bed load samplers, *Trap efficiency, *Fluvial sediments, *Particle size, Sedimentation rates, Sediment discharge, Measurement, Streamflow, Data collections, *Helley-Smith bedload sampler, *Conveyor-belt bedload sampler, *East Fork River(WY).

For sediment particle sizes between 0.50 mm and 16 mm, the Helley-Smith bedload sampler has a near perfect sediment-trapping efficiency. For particles sizes smaller than 0.50 mm, the Helley-Smith sampler has a high bedload sediment-trapping efficiency because part of the sediement retained by the sampler has been transported in suspension and it cannot be quantified separately from the bedload. For particle sizes larger than about 16 mm, the Helley-Smith sampler has low sediment-trapping efficiency but this may be related to the paucity of coarse particles in transport in the calibration tests rather than reflecting an actual low trap efficiency for large-size particles. (USGS)
W81-00363

CONSERVATION IMPACTS AND PRACTICES OF SAND REMOVAL FROM DRY BED OKLAHOMA RIVERS,
Oklahoma State Univ., Stillwater.
J. Harp, and R. C. Chang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124158, Price codes: A03 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University, Technical Completion Report, September 1980. 34p, 4 Fig, 2 Tab, 24 Ref. OWRT-A-092-OKLA(1), 14-34-0001-0138.

Descriptors: *Channel improvements, *Dry beds, Flood plains, Guidelines, Streambeds, Meandering, Physical impacts, Regulations, Removal, Rules, *Sand mining, Effects, *Streamflow, *Sedimentation, Siltine, Urbanization, Storm runoff, Channel flow, Oklahoma.

An analysis of the response of a river system to sand mining requires establishing the morphology and hydraulics of the system prior to man's activities. The complexity of alluvial channel flow and the dynamic nature of river systems are reflected in the large number of interrelated variables necessary to describe natural streams. A number of interdependent factors responsible for changes in channel characteristics are discussed. As a general effect, sand mining decreases the local flow velocity with an attendant increase in flow capacity and more water storage becomes available. The long-term impact depends on the rates of sand removal and natural supply. Overmining results in lowering the base level for upper reaches and tributaries. The reduction of bedload will induce the down stream tendency to decrease the channel width-to-depth ratio and increase the sinuosity. An understanding of the meandering process reveals the best-location and time for mining sand. Not all sand removal activities are detrimental. In fact, if under proper guidance, sand mining can act as a flood plain management factor and produce overall benefits. A set of guidelines for prudent sand mining is presented.
W81-00380

KNICKPOINT MIGRATION DUE TO BASELEVEL LOWERING,
Geological Survey of Israel, Jerusalem.
Z. B. Begin, D. F. Meyer, and S. A. Schumm.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 106, No WW3, Proceedings Paper 15651, p 369-388, August 1980. 18 Fig, 26 Ref, 2 Append.

Descriptors: *Erosion, *Streams, *Model studies, Mathematical models, Hydraulic models, Flumes, Gullies, Sediments, Sediment discharge, Flow, Topography, Channel morphology, Environmental engineering, Agricultural engineering, *Sediment transport, Knickpoint migration.

The migration of knickpoints in alluvial channels was studied in 15-m and 20-m long flumes, sloping at 0.01 cm/cm. The channels were formed in response to baselevel lowering with two modes of migration: (1) migration of a constant vertical knickpoint and (2) migration of an initially vertial knickpoint which flattens and is finally eliminated. Each mode of migration was described by a different equation of motion, which results in a different migration curve. The rate of knickpoint migration hinges upon the channel ability to transport downstream the sediments supplied to it by the receding knickpoint. In this context the mechanism of transport is very important, because wash load is essentially independent of channel attributes. This study showed that in response to baselevel lowering, a knickpoint migrates upstream at a decreasing rate even when water discharge remains constant, and the rate is also affected by the shape of the knickpoints. (Sims-ISWS)
W81-00401

PARTICLE TRANSPORT FROM THE WEST AFRICAN SHELVES OF LIBERIA AND SIERRA LEONE TO THE DEEP SEA: A CHEMICAL APPROACH,
University of South Florida, St. Petersburg. Dept. of Marine Science.
D. W. Eggimann, P. R. Betzer, and K. L. Carder.
Marine Chemistry, Vol 9, No 4, p 283-306, August, 1980. 5 Fig, 3 Tab, 39 Ref, 1 Append.

Descriptors: *Suspended solids, *Sediment transport, *Continental shelf, *Continental slope, Marine geology, Africa, Chemical analysis, Oceans, Aluminum, Iron, Magnesium, Manganese, Silicates, Inorganic compounds, Mineralogy, Tracers, Basin.

Suspended particle transport through the sea was examined over a 480-km section of the Liberia-Sierra Leone continental shelf off West Africa using the chemical and mineralogical composition of the particles as tracers. Ratios of Si/Al, Fe/Al, Mg/Al, and Mn/Al were used to detect shelf-derived matter in slope waters. The use of light-scattering and particle-mass measurements was not applicable to most of the material analyzed, so that chemical identification of particulates was necessary. Suspended particulates and sediments from the adjacent eastern Atlantic basin were similar in chemical and mineralogical composition to those in the water column seaward of the West African continental shelves. However, these basin specimens were distinct from Sahelian dust, which is thought to be the main source of sedimentary matter for tropical and semi-tropical regions of the deep eastern basin. These results indicate that shelf input of matter to the deep sea may be greater than was previously suspected. (Geiger-FRC)
W81-00454

ASPECTS OF DRAINAGE BASIN MORPHOMETRY OF RELEVANCE TO ARCTIC HYDROLOGY,
Winnipeg Univ. (Manitoba).
W. Rannie.
In: Proceedings of the Technology Transfer Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters Directorate, Ottawa,l Ontario, Canda, Technical Workshkop Series No 1, p 10-11, 109-120, 1979. 43 Ref.

Descriptors: *Environmental impact assessment, *Arctic, *Northern development, *Environmental effects, Watersheds, Hydrologic properties, Morphology, Drainage, *Sediment transport, Sediment yield, Equations, Precipitation, Runoff, Morphometric analysis, Glaciation, Canada.

In regions of very little precise data on streamflow and sediment regimes, study of basin properties has relevance for comparative studies within or between regions, the basin properties especially reievant to arctic hydrology are basin aspect, relief, relief distribution, drainage density, drainage area, area of lakes and glacial history. Morphology is also used to prepare prediction equations. A sediment yield equation based on morphologic parameters is presented which appears to have merit for preliminary evaluation of regional sediment transport rates. A description and reason for examining each of these points is discussed. Finally, it is noted that Arctic basins have a number of features in common with urban and semi-arid basins. A review of available models might provide useful data to northern programs. (WATDOC)
W81-00459

2K. Chemical Processes

THE EFFECT OF NITRATE ON NITROUS OXIDE REDUCTION IN ORGANIC SOILS AND SEDIMENTS,
Agricultural Research and Education Center, Belle Glade, FL.
R. E. Terry, and R. L. Tate, III.
Soil Science Society of America Journal, Vol 44, No 4, p 744-746, July-August 1980. 3 Tab, 12 Ref. OWRT-B-041-FLA(1), 14-34-0001-9063.

Descriptors: *Saturated soils, *Denitrification, *Nitrogen cycle, *Organic soils, Soil chemistry, Nitrates, Soil science, Oxides, Sediments, Analytical techniques, Testing procedures, Analysis, Data collections, Chemical reactions, Chemical analysis, Histosols.

Inhibition of N20 reduction by NO3(-) in cultivated Pahokee muck was determined by measuring N20 accumulation in soil samples incubated in the presence and absence of acetylene. At NO3(-)-N levels of 40 mg/liter or greater, nearly 100% of the gaseous denitrification products were N20 in Pahokee muck. Reduction of the accumulated N20 proceeded rapidly after the NO3(-) was exhausted from the soil. In comparison, N20 was readily reduced in ditch sediment samples in the presence of comparable concentrations of NO3(-). With NO3(-)-N concentrations in the ditch sediments ranging from 90 to 39 mg/liter, less than 10% of the gaseous denitrification products were N20. Similarly, NO3(-) levels in soil samples from a vegetable field which had been flooded 22 days had negligible effect on N20 reduction. These data demonstrate that the inhibitory effect of NO3(-) on N20 reduction was less in sediments and in organic soils that had been subjected to prolonged flooding than in the cultivated soils. (Humphreys-ISWS)
W81-00311

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

METHOD FOR BRINGING NUTRIENT-RICH WATER FROM THE APHOTIC ZONE OF THE OCEAN TO THE PHOTIC ZONE,
W. T. Finley.
U.S. Patent No 4,189,379, 4 p, 1 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 988-989, February 19, 1980.

Descriptors: *Patents, *Desalination, *Nutrients, *Water treatment, Oceans, Aphotic zone, Euphotic zone, Electrodialysis, Movement, Conduits.

Nutrient-rich ocean water from the aphotic zone of the ocean, which normally begins at about 100 to 200 meters below the ocean surface, is desalinated or partially desalinated in situ using electrodialysis to leave the nutrients in the water. The nutrient-rich desalinated water thus obtained, being of lesser density than the surrounding seawater, naturally rises through conduits into the relatively nutrient-poor photic zone of the ocean and is dispersed therein, thus increasing the concentration of nutrients in the photic zone near the surface of the ocean. This increases the fertility of the near-surface photic zone, and thus increases the supply of harvestable food fish from the near-surface photic zone. (Sinha-OEIS)
W81-00367

3C. Use Of Water Of Impaired Quality

SALINE WATER UTILIZATION - AN INTERNATIONAL PERSPECTIVE,
New Mexico State Univ., Las Cruces.
G. O'Conner.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 68-77. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003 2 Tab, 9 Ref.

Descriptors: *New Mexico, *Saline water, *Irrigation practices, *Plant breeding, *Crop production, *Halophytes, Sodium, Soil structure, Agricultural engineering, Soil management, Agronomy.

Saline water utilization has tremendous potential in New Mexico and throughout the world. Some early research in Israel utilized very saline groundwater to grow non-halophytic trees and conventional crops, such as sugar beets and barley. In 1977, tomatoes and barley were grown in New Mexico's sand dunes with Pacific Ocean water. Current research approachs to test saline water utilization include using naturally occurring halophytic (salt-tolerant) species to supplement traditional crops, breeding and/or selecting for salt tolerance and substituting saline water for fresh water. Using saline irrigation water can require different management techniques such as, high frequency trickle irrigation, soil amendments (gypsum), increased leaching, and using more salt-tolerant crops. Saline-water utilization may not be feasible for all agricultural settings. Long-term studies of 3 to 5 years are needed. The critical element determining the quality of saline water is the level of total dissolved solids (TSD). (Atkins-Onmiplan)
W81-00395

3D. Conservation In Domestic and Municipal Use

MAKE SEWAGE A VALUABLE COMMODITY,
Westminster, CO.
B. Christopher.
American City and County, Vol 95, No 7, p 47-48, July, 1980. 1 Fig.

Descriptors: *Irrigation practices, *Farms, *Sewage sludge, *Water reuse, *Return flow, Sewage, Waste water disposal, Sewage effluents, Waste water treatment, Sludge disposal, Liquid wastes, Injection wells, Fertilizers, Sewage treatment, Water conservation, Ultimate disposal, Pumping plants.

The city of Westminster, Colorado, in a project 75% funded by EPA, is cooperating with farmers downstream to reuse existing water resources and to make use of waste water effluent. The city's secondary sewage effluent is exchanged for an equal amount of the farmer's irrigation water. Since June 1978, the pumping station at the 2.25 mgd city waste water treatment plant has been pumping 5 acre ft/day effluent to farmers (average daily city water use = 23.63 acre ft). The total water exchanged during the 2-yr program has been 1,206 acre ft. By June 1982, the waste water treatment plant's capacity will have been expanded to 5.0 mgd, and the program will have the potential to provide the city with approximately 2,000 acre ft/yr of exchanged water, enough to support an estimated 6,000 single family dwelling units. Water quality is tested daily, and water tested in August 1977 and August 1978 showed no change in quality. Westminster plans to build a reservoir in which to store its winter effluent until the farmers need it in spring. The second aspect of the reuse plan consists of injecting all the city's liquid sludge from the treatment plant into cultivated farm land, a process more efficient than spreading because it eliminates loss through evaporation of about 70% of the sludge ammonia values. One farmer found that 16 acres of sludge-treated soil produced 19.2 tons/acre of corn compared with 17.6 tons/acre for 16 acres of untreated soil. (Gish-FRC)
W81-00258

WATER CONSERVATION ALTERNATIVES FOR THE NORTH,
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
J. J. Cameron, and B. C. Armstrong.
Economic and Technical Report EPS 3-WP-80-2, 1980. 45p, 5 Fig, 10 Tab, 32 Ref.

Descriptors: *Water conservation, *Wastewater reuse, Public services, Water requirements, *Cost-benefit analysis, Economics, Northwest Territories, *Canada, Pricing, Plumbing codes.

This report reviews water use characteristics, pricing policies, plumbing codes, public acceptance, water conservation experiences, and the methods and technology to reduce water use and the concomitant energy requirements. Various administrative alternatives and water conservation technology for toilets, bathing, laundry, kitchen and households are analyzed with respect to appropriateness, public acceptance and cost-effectiveness. Economic analyses and water conservation strategies for both trucked and piped utility systems are presented. Trucked systems are preferred in communities with limited water supplies, and very low water use fixtures such as recirculating toilets, self-closing hand-held shower units and spray faucets are recommended. If a central laundry facility is installed, household water requirements can be reduced to only 13 litres per person per day. A final recommendation is made for a water conservation demonstration project to monitor retrofit and new installation for both the piped and trucked systems. (WATDOC)
W81-00384

3E. Conservation In Industry

THE IMPACT OF ENERGY DEVELOPMENT ON WATER RESOURCES,
New Mexico Energy and Minerals Dept., Santa Fe.
L. Kehoe.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 160-174, New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *Synthetic fuels, *New Mexico, *Water utilization, *Natural resources, *Coal, *Energy development, Oil shale, Legislation, Research and development, Energy conversion, Surveys, Biomass, Fossil fuels, Natural gas, Water allocation.

An overview of President Carter's synthetic fuels program, its relation to water usage and the availablility of natural resources in New Mexico is presented. The $80 billion synfuels program is expected to produce the equivalent of 2.5 million barrels of oil a day from coal liquefaction, coal gasification, oil shale biomass and unconventional gas. The reports supporting this replacement of oil do not include information on the water usage that will be involved. Figures are shown comparing projected U.S. synfuels production in 1985 and in 1980 using low-, medium-, and high-effort scenarios. A seven-fold increase is expected during this time using a 'crash program.' A second figure shows the relative magnitude of production by various sources of synfuels with almost one-half of the total goal expected to come from coal liquids and gases. New Mexico's fossil fuel supply, over three-quarters coal, may play a significant role in that production. These new fuel sources will require more water than current energy sources. The amount of water tp produce 1 quad BTU for seven traditional and proposed fuel sources is depicted Production of high BTU coal gasification requies nearly fifteen times as much water as the present technology to produce natural gas. Public attitude surveys regarding water, its applications, and energy resources and development as related to the total social and economic structure in New Mexico are discussed. (Vernale-Omniplan)
W81-00397

3F. Conservation In Agriculture

MAKE SEWAGE A VALUABLE COMMODITY,
Westminster, CO
For primary bibliographic entry see Field 3D.
W81-00258

A REGIONAL EVALUATION OF OFF-SEASON AGRICULTURAL USE OF WATER AND ENERGY RESOURCES,
South Dakota State Univ., Brookings. Water Resources Inst.
M. L. Horton, C. G. Carlson, R. E. Beyer, L. R. Stone, and R. E. Gwin, Jr
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127342, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, October, 1980. 89 p, 36 Fig, 44 Tab, 41 Ref. OWRT-B-052-SDAK(1), 14-34-0001-7187.

Descriptors: *Irrigation practices, *Supplemental irrigation, *Irrigation effects, *Evaluation, *Crop production, Irrigation, Experimental farms, Montana, Kansas, South Dakota, Irrigation water, Irrigation systems, Water utilization, Winter, Excess water(Soils), Autumn, Wheat, Alfalfa, Assessments, Crop response.

The underlying assumption for off-season irrigation has been that irrigation up to field capacity during the low evaporative demand seasons, Fall, early/late Winter, and early Spring, would represent an efficient use of irrigation water. The major question analyzed in this study was: would off-season irrigation be a practical and workable practice. The study was carried out by three independent research groups in Montana, Kansas, and South Dakota, and the three reports were separately presented. For South Dakota, the winter wheat crop did not appear to have increased winter survivability from fall irrigation, and weeds appeared much less manageable. If Fall irrigation is to be practiced, one-half the available soil moisture content should be the upper limits of off-season profile filling. For Montana, the second cutting in the Fall of 1979 was the only significantly different alfalfa

yield. Poor efficiencies were noted for Fall irrigations, with an apparent decrease in Fall-applied water carryover when the profile is filled above half of its water holding capacity. For Kansas it was concluded that Fall irrigation increasing the profile soil water content above 18 inches would be relatively inefficient in providing water for the next summer's crop. (Zielinski-IPA)
W81-00314

DRIP IRRIGATION SYSTEM,
Vernay Labs., Inc., Yellow Springs, OH. (Assignee).
G. E. Atkinson, and K. C. Tregillus.
U.S. Patent No 4,190,206, 5 p, 11 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 991, No 4, p 1267, February 26, 1980.

Descriptors: *Patents, *Irrigation systems, *Application equipment, *Flow control, Irrigation efficiency, Irrigation operation and maintenance, Drip irrigation.

A drip irrigation system includes a flow control valve having an inlet opening which constricts in response to pressure increases to provide a uniform flow dispite pressure variations. The inlet opening of the valve has a rectangularly cross-sectioned central section and end sections which are non-rectangular, such as triangular or semi-circular, in cross section. During normal flow conditions the rectangular central section of the inlet opening is pressed closed and irrigation liquid flows at a constant rate through the two end sections. (Sinha-OEIS)
W81-00368

SELF-CORRECTING LINEARLY MOVABLE IRRIGATION SYSTEM,
Gifford-Hill and Co., Inc., Tulsa, OK. (Assignee).
G. A. Beusch, H. L. Thompson, H. E. Lindner, and G. G. Jones.
U.S. Patent No 4,190,068, 16 p, 7 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 991, No 4, p 1219, February 26, 1980.

Descriptors: *Patents, *Irrigation systems, *Sprinkler irrigation, *Application equipment, Lateral conveyence structures, Irrigation efficiency, Irrigation operation and maintenance.

A linearly movable irrigation system includes interconnected power driven irrigation spans supporting a water supply conduit, whose sections are capable of moving over a land area and depositing a controlled amount of water. At one extremity of the irrigation system a steerable and powered mover unit is provided that accepts water from a water supply system and conducts it to the overhead irrigation pipe under sufficient pressure to cause proper distribution of water through sprinkler devices located along the length of the irrigation conduit. A power driven pump is supported by the steerable mover unit in order to pressurize or provide boosting pressure for the water. The steerable mover unit is adapted to move in proximity to an elongated reference which may be straight or curved as desired. The unit is provided with means for sensing stresses and angular relationship of the irrigation spans relative to the mover unit for providing control signals to the irrigation system that maintain stresses and angular misalignment of the system within an acceptable range. Each extremity of the irrigation system may move at different average speeds which are determined by the control signals for corrective relative movement. The extremities of the irrigation system may also move simultaneously at equal speeds or at different speeds to accomplish controlled movement during irrigation operations. (Sinha-OEIS)
W81-00369

SIMPLIFIED IRRIGATION CONTROLLER,
Toro Co., Riverside, CA. (Assignee).
T. L. Kendall.
U.U. Patent No 4,189,776, 16 p, 9 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 1103, February 19, 1980.

Descriptors: *Patents, *Irrigation systems, *Control systems, Automatic control, Scheduling, Electronic equipment, Instrumentation, Irrigation efficiency.

The invention discloses a simplified solid state controller for use in controlling automatic irrigation systems. The operator input panel provides no means for the inputting of numerical irrigation information such as station start times and station run times. Rather, the input panel provides switch means whereby the operator can initiate a number of parameterization logic sequences where the current information data in memory is displayed to the operator. Through the input panel, the operator can cause the information displayed to be advanced to a new desired value an a step-by-step basis. Upon the displayed value being equal to the value desired as the new value by the operator, the operator signals to the logic of the controller through the input panel and the current value is updated to the presently displayed value. (Sinha-OEIS)
W81-00370

IMPORTANCE OF CROP PRODUCTION FUNCTIONS IN EVALUATING CONSUMPTIVE USE OF WATER,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
E. G. Hanson, and T. W. Sammis.
In: A Quater Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 36-58. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003 14 Fig, 1 Tab, 13 Ref.

Descriptors: *New Mexico, *Crop production, *Irrigation, *Evapotranspiration, *Crop production functions, *Consumptive use, *Soil moisture, Grain crops, Lysimeters, Irrigation effects, Crop response, Plant growth, Field crops.

Determining consumptive use, also called evapotranspiration (ET), of selected crops and relating ET data to crop yield is required for many purposes. These include planning efficient irrigation systems, determining irrigation requirements and equitable water rights, and evaluating the life expectancy of water supply in underground basins. Normal consumptive use is the ET rate that occurs when crops produce average yields and may be determined by plotting the average yields on crop-production functions. Alfalfa, grain corn, cotton, chile and grain sorghum were grown at selected locations throughout New Mexico during 1976, 1977 and 1978. The Et rate was measured with a non-weighing type lysimeter and water balance technique. Yield was measured from the lysimeter and adjacent field at harvest time. Neutron access tubes installed in the lysimeters measured weekly changes in soil moisture every 15 cm of depth. Water applied by sprinkler-line source was measured with catchment cans. These data and data from other irrigation projects were used to derive crop-production function for each crops, excluding chile. Crop-production functions having high coefficients of determination appear to be a better method of estimating the normal ET required in an area. A more direct correlation was found between ET and alfalfa yield than for ET and grain crop yields. Variables that cause a reduction in ET may cause a corresponding reduction in crop yield. These variables include water stress, solar radiation, temperature, management, insects, grazing and increased soil salinity. (Vernale-Omniplan)
W81-00393

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

STORMWATER MANAGEMENT IN THE UNITED STATES A STUDY OF INSTITUTIONAL PROBLEMS, SOLUTIONS AND IMPACTS,
Stormwater Consultants, Bolingbrook, IL.
H. G. Poertner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121048, Price codes: A11 in paper copy, A01 in microfiche. Report, September 1980, 240 p, 6 Fig, 12 Tab, 5 Append. OWRT-C-5239(No 4235)(1), 14-31-0001-4235.

Descriptors: *Administration, *Management, *Urban drainage, *Storm water, *Institutional constraints, Local governments, Runoff, Storm runoff, Urban runoff, Financial feasibility.

Personal interviews were conducted in many urban and metropolitan areas of the United States to investigate institutional problems in stormwater management. Successful solutions and the impacts and transferability of solutions were studied in detail. The objective was to prepare a report useful to local public officials and management personnel in developing and operating effective, economical and timely programs and facilities for managing stormwater. Extensive case studies were made of: Cook County, Illinois; Metropolitan Denver, Colorado; Fairfax County, Virginia; and the City and County of Tulsa, Oklahoma. The studies addressed the broad field of stormwater management, including both 'control' and 'developmental' activities. The institutional problems investigated were those that typically arise in creating, supporting and operating local stormwater management organizations and programs. Also studied were the institutional problems associated with implementation activities, including: planning, engineering, constructing, operating and maintaining physical facilities. These various problems are characterized in the report as: financial, administrative, organizational, jurisdictional, legislative, legal, political, social, economic, environmental, ecological, planning, public education and communication. Findings of the study and the author's conclusions and recommendations are given in the first chapter.
W81-00263

PERFORMANCE AND EFFECTS OF SCS FLOODWATER RETARDING STRUCTURES IN THE 1979 EASTER FLOODS,
Soil Conservation Service, Jackson, MS.
P. Forsythe, and R. Ulmer.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 61-63, (1979) 2 Fig.

Descriptors: *Mississippi, *Flood control, *Flood drainage, *Farm ponds, Dams, Spillways, Scour, Erosion, Channels, Soil Conservation Service, Cow paths, Impoundments, Overflow, Flood flow, Spillway crests.

The performance of the floodwater retarding structures and farm ponds in the Pearl River Basin during the 20 + inch rainfall of April 12-13, 1979 was excellent. In general, failures occurred where proper design and maintenance were not provided. Ninety-nine percent of the farm ponds performed as designed without failure. The storm was massive, 2.4 times the 100 year-24 hr rainfall and 69% of 6 hr PMP. The Soil Conservation Service floodwater retarding structures are not designed for so large a storm but they performed well with only minor damage. Turbulence and scouring occurred in and beyond some emergency spillways due to fences and cow paths. Hop and skip flow conditions initiated by surface irregularities caused minor damages in the $1,000 to $5,000 range. Some farm pond failures can be attributed to debris plugged screens across spillways. Much more damage and inundation of urban areas would have occurred without the successful performance of the retarding structures. (See also W81-00290) (Seigler-IPA)
W81-00302

GREEN RIVER BASIN FLOW FORECASTING MODELS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
P. G. Katz, and G. H. Toebes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124448,

Price codes: A10 in paper copy, A01 in microfiche. Technical Report No 136, October 1980. 193 p, 56 Fig, 53 Tab, 17 Ref, 4 Append. OWRT B-094-IND(4).

Descriptors: *Streamflow forecasting, *Model studies, *Kentucky, *Reservoir operation, Reservoir releases, Reservoir storage, River forecasting, Flow nets, Reservoirs, *Green River Basin(KY).

River flow-watershed runoff models of the Green River Basin in Kentucky are needed for the efficient operation of the basin's reservoirs. Correlative linear models that relate reach outflow to reach inflows and to precipitation over the side-inflow contributing watersheds offer a relatively simple, easy to use method of satisfying the requirements. Difference models were constructed for the 9 river reaches into which the Green River System had been divided previously. Submodels and the basin model made by linking the submodels together were found to perform better than the linear models constructed earlier. Premultiplication of the precipitation by the average monthly runoff coefficient prior to the model identification phase was found to improve the forecasting accuracy of the resulting difference model. Problems which may be encountered in using the difference model with premultiplication of precipitation by the average monthly runoff coefficient for real-time forecasting were considered. In conjunction with this the manual flow forecasting methods used by Louisville District of the Corps of Engineers were examined. An automated procedure, called 'Computed Hydrograph Adjustment Technique' (CHAT) was shown to offer a potential for further model improvement.
W81-00329

WINTER WATER--THE FLOODING AT BOISE, IDAHO, JANUARY 11-12, 1979,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 2E.
W81-00364

4B. Groundwater Management

GROUND WATER MINING AND WESTERN WATER RIGHTS LAW: THE NEBRASKA EXPERIENCE,
Nebraska Univ., Lincoln.
For primary bibliographic entry see Field 6E.
W81-00269

AREAS OF NATURAL RECHARGE TO THE FLORIDAN AQUIFER IN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. W. Stewart.
Florida Bureau of Geology Map Series 98, 1980. 1 Sheet, 4 Fig, 11 Ref.

Descriptors: *Maps, *Natural recharge, *Aquifers, *Groundwater, *Florida, Aquifer characteristics, Surface waters, Potentiometric level, Water wells, Withdrawal, Water table, Pumping, Artificial recharge, Water quality, Water supply, Hydrogeology, *Floridan aquifer.

The Floridan aquifer, the most extensive and widely used aquifer system in Florida, consists chiefly of limestone and dolomite. The aqifer is at or near land surface in northwest and north-central Florida and about 1,000 feet below land surface in northwest and south Florida. It is overlain by surficial materials ranging in thickness from a few feet to several hundred feet, including water-bearing sands. Water is unconfined in the surficial aquifer and confined in the Floridan aquifer. Three types of classifications are used to delineate the relative effectiveness of natural recharge areas of the Floridan aquifer: least effective, moderately effective, and most effective. The least effective recharge areas are areas of artesian flow where the potentiometric surface of the Floridan aquifer is above land surface and recharge of the aquifer can not occur under natural conditions. About 50 percent of the State falls within this classification. The moderately effective recharge areas represent about 35 percent of the State and recharge rates are estimated to range from less than 1 to 10 inches per year. The most effective areas represent about 15 percent of the State and recharge rates range from about 10 to 20 inches per year. (USGS)
W81-00345

THE SURFICIAL AQUIFER AT THE U.S. NAVAL STATION NEAR MAYPORT, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-00349

EVALUATION OF A CAVITY-RIDDLED ZONE OF THE SHALLOW AQUIFER NEAR RIVIERA BEACH, PALM BEACH COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. N. Fischer, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115776, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-60, 1980. 39 p, 13 Fig, 7 Tab, 13 Ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water quality, *Water yield, *Florida, Hydrogeology, Water supply, Saline water intrusion, Water pollution sources, Water wells, Water analysis, Evaluation, *Palm Beach County(FL), *Riviera Beach(FL).

The shallow aquifer near Riviera Beach, Palm Beach County, Fla., contains a cavity-riddled zone extending north and south about 5 miles inland from the Atlantic Ocean. The zone lies at approximately 60 feet below land surface and varies from 15 to 50 feet in thickness. It is approximately 3 miles in width. Aquifer material is calcareous quartz sand-stone in the cavity zone, whereas the remainder of the consolidated aquifer material is primarily limestone. The zone is overlain by several thin clay beds which provide varying degrees of confinement. The transmissivity of the cavity-riddled zone of the aquifer in the area of investigation is approximately 11,000 square feet per day. Preliminary evaluation indicates that large volumes of water of suitable quality for public supply can be developed from the zone, except in an area adjacent to a landfill where leachate has adversely affected water quality. (USGS)
W81-00351

4C. Effects On Water Of Man's Non-Water Activities

TWO APPROACHES TO IDENTIFY STORM WATER RUNOFF LOADS,
Geological Survey, NSTL Station, MS. Gulf Coast Hydroscience Center.
W. H. Doyle, and M. E. Jennings.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 101-106, (1979) 8 Fig, 5 Ref.

Descriptors: *Miami, Florida, *Houston, Texas, *Storm runoff, *Urban runoff, Water pollution sources, Sampling, Overland flow, Monitoring, Model studies, Computer models, Computer programs, Hydrologic data, Land use, Rainfall-runoff relationships.

Houston, Texas, and Miami, Florida, were the sites for two urban stormwater studies comparing a coarse modeling technique and an intense data collection modeling technique. In Houston the rapidly urbanizing Buffalo Bayou basin encompassing 975 sq mi was used. A broad-scale model, STORM (storage, treatment, overflow, and runoff), was used. It was calibrated for each of eight watersheds and five land use characteristics. Results show that annual storm-runoff loads ranged from 43 to 97% of total basin load. The Houston study illustrated the successful application of the broad-scale identification approach. The Miami study used a comprehensive data collection network to identify urban pollutant sources by sampling in small catchments of similar land use. An automated monitoring system was used to record rainfall and stage data and to activate the water sampling equipment. A data management system was developed to process the masses of data. Provided that funding and manpower are available this intensive approach can be successfully used to identify pollutants by land-use type. (See also W81-00290) (Seigler-IPA)
W81-00310

SUSPENDED-SEDIMENT DISCHARGE, IN FIVE STREAMS NEAR HARRISBURG, PENNSYLVANIA, BEFORE, DURING, AND AFTER HIGHWAY CONSTRUCTION,
Geological Survey, Harrisburg, PA. Water Resources Div.
L. A. Reed.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.25. Geological Survey Water-Supply Paper 2072, 1980. 37 p, 17 Fig, 8 Tab, 10 Ref

Descriptors: *Sediment transport, *Sediment discharge, *Stream, *Road construction, *Pennsylania, Sediment load, Particle size, Streamflow, Turbidity, Rainfall-runoff relationships, Farm ponds, Tap efficiency, Erosion control, Sediment control, Basic data collections, *Harrisburg(PA), Pre-construction data, Cost-construction data.

Rainfall, streamflow, sediment, and turbidity data were collected as part of a study to evaluate the effects of highway construction on suspended-sediment discharges in stream near Harrisburg, PA. The study was also designed to evaluate the effectiveness of different erosion-control measures in reducing sediment discharge. Although highway construction increased suspended-sediment discharges from two to four-fold, the rate of sediment discharge quickly returned to pre-construction levels when construction ended. The most effective sediment control evaluated was offstream ponds, which were designed to trap and store sediment laden water from the construction area. The offstream ponds trapped about 70 perent of the sediment that reached them during most storms. Seeding and mulching generally reduced sediment loads about 20 percent. Rock dams and bales reduced loads about 5 percent. An onstream pond, constructed on a large stream below the construction area, reduced sediment loads about 80 percent. However, unlike the offstream ponds, which stopped discharging runoff water soon after precipitation ended, the onstream pond kept discharging runoff water, and the stream below the pond remained turbid for extend periods. (USGS)
W81-00361

4D. Watershed Protection

USE OF BOUNDING WELLS TO NEGATE THE EFFECTS OF GRAVITY AND PRE-EXISTING GROUNDWATER MOVEMENT IN DIPPING AQUIFERS USED FOR STORAGE,
Louisiana State Univ., Baton Rouge. Dept. of Petroleum Engineering.
P. J. Abadie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124554, Price codes: A06 in paper copy, A01 in microfiche. Master of Science Thesis, August, 1979. 100 p, 8 Fig, 2 Tab, 16 Ref, 2 Append. OWRT-A-044-LA(2).

Descriptors: *Wells, *Aquifer management, *Laboratory equipment, *Mathematicat models, *Groundwater movement, *Gravity, *Underground storage, *Water loss, *Water conservation, Groundwater, Percolation, Water management(Applied), Water measurement, Flow measurement, Water, Injection wells, Water storage, Freshwater, Gradients(Streams), Mathematical studies.

Fresh water stored in a dipping saline aquifer results in the imigration of the bubble of injected water away from the injection/production well

due to pre-existing groundwater movement and gravity, possibly rendering a storage project economically useless due to low recovery of the injected fresh water. Bounding wells partially offset the deleterious effects of pre-existing flow and gravity. A computational procedure was developed for predicting the bounding well rates needed to negate the combined effects of pre-existing flow and gravity, and was verified using a laboratory size miniature aquifer. Efficacy of the bounding well systems studied was quantified by measuring recovery efficiencies (fraction of fluid recovered). Pre-existing flow and gravity tended to cause the injected fluid to migrate downdip in all runs. The injected fluid volume and the injection/production rate was the same for all runs. With a dip angle of 30 degrees, a density difference of 0.0163 g/cc and a pre-existing gradient of 0.05 psi/ft, recovery efficiency was 51.7% with no bounding wells; and 95.3% operating the bounding wells at the computed rates for this system. At a density difference of 0.55 g/cc, recovery efficiency was 33.6% and 20.9% with and without bounding wells. (Zielinski-IPA)
W81-00312

SUSPENDED-SEDIMENT DISCHARGE, IN FIVE STREAMS NEAR HARRISBURG, PENNSYLVANIA, BEFORE, DURING, AND AFTER HIGHWAY CONSTRUCTION,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W81-00361

CONSERVATION IMPACTS AND PRACTICES OF SAND REMOVAL FROM DRY BED OKLAHOMA RIVERS,
Oklahoma State Univ., Stillwater.
For primary bibliographic entry see Field 2J.
W81-00380

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DIRECT DETERMINATION OF LEAD IN POLLUTED SEA WATER BY CARBON-FURNACE ATOMIC ABSORPTION SPECTROMETRY,
Napier Coll. of Commerce and Technology, Edinburgh (Scotland). Dept. of Biological Sciences.
M. C. Halliday, C. Houghton, and J. M. Ottaway.
Analytica Chimica Acta, Vol 119, No 1, p 67-74, September 1, 1980. 4 Tab, 24 Ref.

Descriptors: *Lead, *Sea water, *Spectrometers, *Analytical techniques, *Water sampling, Water pollution, Trace elements, Pollutant identification, Ammonium compounds, Instrumentation, Filtration, Salts, Dissolved compounds, Testing procedures, Water analysis, Chemical analysis.

A Perkins-Elmer 373 atomic absorption spectrometer equipped with a heated graphite atomizer HGA 2200 was used for the direct determination of lead in polluted sea water. The water was obtained from the outer Firth of Forth, filtered, then diluted (1 + 1) with deionized distilled water and ammonium nitrate (as a matrix modifier). Aliquots were injected into the furnace, which was equipped with a tantalum-coated graphite tube, under gas-stop conditions. The matrix modifier and the tube coating reduced the suppressive effects on the signal of salts present in the water to such a degree that the quantity of lead could be determined by the method of standard additions. When the sea water was not filtered prior to analysis, the variability in results was excessive. However, the results obtained by carbon-furnace atomic absorption spectrometry correlated significantly with those obtained by anodic stripping voltammetry ($r = 0.84$, $p < 0.01$) and were not significantly different according to the paired t test ($t = 0.93$). A marked improvement in reproducibility was achieved by filtration of the water, yielding a detection limit of 1 microgram Pb/liter. The method described allows the rapid screening of a large number of samples (approximately 50/day) with minimal effort if an automatic sampling device is used. (Gish-FRC)
W81-00253

FATE OF COLIFORM BACTERIA IN THE UPPER NEW YORK BAY,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
M. S. Finstein, and M. L. Morris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-126534, Price codes: A03 in paper copy, A01 in microfiche. Final Report, October 1980. 4 p, 1 Fig, 11 Tab, 35 Ref. OWRT-A-049-MJ(1), 14-34-0001-8032.

Descriptors: *New York Bay, *Sewage effluents, *Coliforms, *Sewage bacteria, E. coli, Enteric bacteria, Water pollution sources, Microbiology, Waste water treatment, Chlorination, Water sampling, Environmental effects, New Jersey.

Quantitative and qualitative analyses were made of the coliforms in both the primary treated effluent and the receiving waters (New York Bay) of the Passaic Valley Sewerage Commissioners (PVSC) treatment plant. The membrane procedure was used to determine standard coliform counts and colonies were identified with the API 20E enteric identification system which consists of a battery of 23 biochemical tests. Treatment at the PVSC plant consists of primary sedimentation and, in season, chlorination. Water samples were taken at 11 stations in the Bay with a Kemmerer bottle. Sediment samples were taken with an Eckman dredge and were diluted with a phosphate buffer solution. The standard coliform count of the effluent was 100,000 to 5,000,000/ml. In order of abundance the major coliforms were: Klebsiella pneumoniae, Enterobacter cloacae, Citrobacter freundii, and Escherichia coli. In the Bay near the discharge field, the coliform count ranged from 210 to 740/ml. Leading contributors were: Enterobacter cloacae, Klebsiella pneumoniae, Citrobacter freundii, Escherichia coli, and Aeromonas hydrophila. Laboratory studies showed that the addition of effluent slow the disappearance of three of the coliforms from Bay water. (Seigler-IPA)
W81-00324

SOLUBILITIES OF PHENOL AND CHLORINATED PHENOLS IN SUPERCRITICAL CARBON DIOXIDE,
Delaware Univ., Newark. Dept. of Chemical Engineering.
R. Van Leer, A. Van Leer, and M. E. Paulaitis.
Journal of Chemical and Engineering Data, Vol 25, No 3, p 257-259, July 1980. 3 Fig, 3 Tab, 5 Ref. OWRT-A-045-DEL(2).

Descriptors: *Chlorine, *Carbon dioxide, *Phenols, *Solubility, Solvents, Solutes, Chemical precipitation, Saturation, Chemical properties, High pressure, Liquids, Waste water(Pollution), Columns.

The solubilities of three common waste water pollutants, phenol, p-chlorophenol, and 2,4-dichlorophenol, were measured in supercritical carbon dioxide as a function of pressure. Measurements were made at 36C over a range of 80 to 250 atmospheres. Phenol was also tested at 60C over the same range of pressures. For the testing liquid carbon dioxide at ambient temperature was charged into a Milton Roy high-pressure liquid pump to produce the desired pressures. The pump continuously delivered solvent at flow rates from 60 to 300 standard cu cm/min. The solvent was fed into two high-pressure equilibrium cells connected in series. The cells were columns packed with glass beads and the heavy solute. After leaving the cells the saturated solution was flashed to atmospheric pressure and the heavy component was collected in a cold trap to be measured with a wet-test meter. Results are given as tables and as plots. At 36C the solubility of phenol is similar to that of other solid-super critical fluid systems. At 36C the isotherms for p-chlorophenol and 2,4-dichlorophenol are characteristic of liquid-supercritical fluid systems. The results indicate that the solubilities in supercritical carbon dioxide increase as the number of chlorine groups on the solute increase, probably due to the decreased bonding in the condensed phase. (Seigler-IPA)
W81-00340

IDENTIFICATION AND CONFIRMATION OF ATRAZINE IN POND WATER,
Colorado State Univ., Fort Collins. Inst. of Rural Environmental Health.
M. J. Aaronson, K. W. Kirby, and J. D. Tessari.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 492-497, September, 1980. 4 Fig, 1 Tab, 3 Ref.

Descriptors: *Triazine pesticides, *Farm ponds, *Fishkill, *Organophosphorus pesticides, Pesticides, Atrazine, Cyanazine, Gas chromatography, Mass spectrometry, Ponds, Farms, Degradation(Decomposition), Aquatic environment, Ecosystems, Thiocarbamate pesticides, Pollutant identification.

Large fishkills in a farm pond were attributed to atrazine, although the surrounding farmland showed recent applications of only Bladex (cyanazine), Counter (an organophosphate), and Sutan (a thiocarbamate). Pond water samples were extracted into methylene chloride. The latter two compounds were unidentifiable upon gas chromatographic/mass spectrometric analyses of extracts. The presence of atrazine in the pond water was positively confirmed, but its origin remained unknown. Private reports stated that cyanazine in soil would undergo degradation of the nitrile to form an amide which would convert to the acid with subsequent decarboxylation. From this process, atrazine would derive from cyanazine. Other experiments have shown that atrazine remained in the physical and biological components of pond water following a period of 2 yr after application. The possibility of atrazine entering the aquatic ecosystem after land application appears to be very high. (Geiger-FRC)
W81-00412

PRIORITY POLLUTANT ANALYSES OF INDUSTRIAL WASTEWATERS USING A MICROEXTRACTION APPROACH,
Southwest Research Inst., San Antonio, TX. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 7B.
W81-00445

EXPERIMENTAL APPLICATION OF GAS CHROMATOGRAPHIC HEADSPACE ANALYSIS TO PRIORITY POLLUTANTS,
Greenwood Lab., Kennett Square.
For primary bibliographic entry see Field 7B.
W81-00446

ESTIMATED APPLICATION OF GAS CHROMATOGRAPHIC HEADSPACE ANALYSIS TO PRIORITY POLLUTANTS,
Catalytic, Inc., Philadelphia, PA. Environmental Systems Div.
For primary bibliographic entry see Field 7B.
W81-00447

APPLICATION OF CURRENT METHODS FOR METALS DETERMINATION IN WASTEWATERS FROM THE ORGANICS/PLASTICS INDUSTRY,
Gulf South Research Inst., New Orleans, LA.
C. S. Monteith, and J. E. Gebhart.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 503-511, 1980. 2 Tab, 3 Ref.

Descriptors: *Heavy metals, *Spectrophotometry, *Water analysis, *Organic wastes, Water pollution, Trace elements, Effluent streams, Industrial wastes, Digestion, Chemical wastes, Pollutant identification, Analytical techniques, Laboratory tests.

Aqueous samples taken from various process and effluent streams of organic and plastic chemical

industries were analyzed for 13 trace elements from the EPA list of priority pollutants by three laboratories using atomic absorption spectrophotometry. Cadmium, chromium, copper, lead, antimony, arsenic, beryllium, mercury, nickel, selenium, silver, thallium, and zinc were the elements determined. Sample preparation differed slightly in each laboratory. In two of the three laboratories, metal species which were recoverable in hot nitric acid, namely metals in the ionic state, were determined. The other laboratory used digestion methods to recover 'total' metals, meaning metals in the covalently bound state and in the ionic state. More rigorous digestion conditions were needed for recovery of covalently bound metals, so that a greater portion of the spike was lost than when using the digestion procedure employed by the other two laboratories. Another factor affecting recoveries of elements was the laboratory which analyzed the samples. It was suggested that mixtures of free and organically bound forms of elements be used as spikes to render a more realistic evaluation or recovery of 'total' metals to be made. (Geiger-FRC)
W81-00450

ANALYTICAL PROBLEM SOLVING WITH VERIFICATION SAMPLES INTERFERENCE REDUCTION OPTIONS,
PJB Laboratories/Jacobs Engineering, Pasadena, CA
C. Jackson, R. Pavlick, H. Scholtz, and D. R. Rushneck.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 513-523, 1980. 5 Fig, 8 Ref.

Descriptors: *Gas chromatography, *Pollutant identification, *Waste water(Pollution), *Separation techniques, Analytical techniques, Water-analysis, Hydrogen ion concentration, Mass spectrometry, Water pollution sources, Water chemistry, Chemical analysis, Sodium sulfate.

Gas chromatographic analysis of pollutants in waste waters may be complicated by the difficulty of separating the pollutant from the complicated matrices that can occur in process waste streams After direct aqueous injection and microextraction have been performed to detect the compound of interest and it has been determined that interference exists, the simplest method to reduce this is to examine the relationship of the pH of the sample and interference. It the latter is pH sensitive and the compound is not, exchanging the pH of the water usually eliminates interference. If the reverse is true, column chromatography usually retards the compound, while the interference is eluted and discarded. A microcleanup technique, in which microextracts are subjected to Florisil column chromatography, may be used. This method requires 1-1/2 cm Pr-grade Florisil (180 mg) with 2 cm sodium sulfate in a disposable Pasteur pipette An aliquot of the microextract (0.5 milliliter) is placed on the column and eluted with 2 milliliters of hexane. The column is then eluted with 2 milliliters of 20% ether in hexane, and the eluate analyzed for polar compounds. Other techniques are useful for reducing interferences in the case of particular compounds. Certain interferences may require cleanup by molecular weight distribution, separation by capillary columns, or the use of precolumns and back-flushing techniques. The analytical method is verified by spiking, a recovery of 50-150% of the spike validating the method. It is possible, using such techniques, to solve nearly every interference problem without resorting to mass spectrometry. (Gish-FRC)
W81-00452

AN EVALUATION OF FACTORS AFFECTING THE MICROEXTRACTION OF BENZENE, TOLUENE, ETHYLBENZENE AND O-XYLENE INTO PENTANE,
Little (Arthur D.), Inc., Cambridge, MA.
For primary bibliographic entry see Field 7B.
W81-00453

CHARACTERISTICS OF GEL CHROMATOGRAPHY USING SEPHADEX GEL FOR FRACTIONATION OF SOLUBLE ORGANIC POLLUTANTS,
Yokohama National Univ. (Japan). Dept. of Safety and Environmental Engineering.
For primary bibliographic entry see Field 7B.
W81-00493

MUTAGENICITY IN SALMONELLA OF FLUORESCENT DYE TABLETS USED IN WATER TRACING,
Health and Welfare Canada, Ottawa (Ontario). Environmental and Occupational Toxicology Div.
E. R. Nestmann, D. J. Kowbel, and J. Ellenton.
Water Research, Vol 14, No 7, p 901-902, July, 1980. 1 Fig, 13 Ref.

Descriptors: *Fluorescent dye, *Toxicity, *Tracking techniques, Bioindicators, Water pollution, Salmonella, Public health, Tracers, Mutagens, Bacteria

Red and yellow/green fluorescent dye tablets currently used for water tracing were evaluated for their mutagenicity to five strains of Salmonella typhimurium. Rhodamine B and Uranine containing dyes were tested using the Ames procedure for bacterial His(+) revertants in the presence or absence of S9 mix. Red tablets containing Rhodamine B increased the number of His(+) revertant colonies in strains TA1538 and TA98 in the presence of S9 in a dose-dependent manner. Fluorescent yellow/green tablets containing Uranine (Fluorescein Sodium) showed no mutagenic activity in any of the strains tested. Since these dyes are available for commercial, public, and field use in sewage, plumbing, and water pollution tracing, it was recommended that in vivo mutagenicity/carcinogenicity studies be performed to assess possible hazards of these products to humans. (Geiger-FRC)
W81-00497

5B. Sources Of Pollution

THE INFLUENCE OF P-RETENTION BY SOILS AND SEDIMENTS ON THE WATER QUALITY OF THE LIONS RIVER,
H. D. Furness, and C. M. Breen.
Journal of the Limnological Society of Southern Africa (Bloemfontein), Vol 4, No 2, p 113-118, 1978. 1 Fig, 6 Tab, 30 Ref.

Descriptors: *Phosphorus compounds, *Soils, *Sediments, *Retention, *Water quality, Nutrient removal, Leaching, Rivers, Fluvial sediments, Phosphates, Fertilizers, Runoff, Watersheds(Basins), Eutrophication, Movement, Suspended solids, Evaluation, Particle size, Soil texture, Sands, Aluminum, Mathematical studies, Correlation analysis, Algae, Nitrogen compounds, South Africa, *Lions River(South Africa), *Midmar dam catchment(South Africa).

The impact of phosphorus-retention by soils and sediments on the concentration of phosphorus in the water of the Lions River, Midmar dam catchment area, South Africa, is reported. The amount of phosphorus added to the catchment area was estimated by fertilizer sales and the river sediment and water samples from six sites were analyzed for pH, P04-P, total-P, Al, and cation concentrations. The amount of P-retention by the specific soils was reduced when more fertilizer had been applied, even though all soils have high P-retention properties. This may be due to saturation of the Al sites of the soil particles which bind phosphorus. The P-retention ability was also found to be dependent on the sediment texture, with sand having the least ability and clay having the best. There is a significant negative correlation between pH and Al (3+) concentration. The concentrations of P04-P in the water possibly reflects an equilibrium between the sediment and the water and if the pH of the sediment decreased, more P would be liberated into the water. The P retention properties of the soils will keep P concentrations from the Lions River low and not much P04-P will reach the Midmar dam. Nitrogen is probably the limiting factor for algae growth in the dam, not phosphorus. (Sidney-IPA)
W81-00338

WATER QUALITY DEGREDATION DUE TO NON-POINT POLLUTION FROM URBAN SOURCES,
Delaware Univ., Newark. Dept. of Civil Engineering.
J. B. Carberry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124364, Price codes: A05 in paper copy, A01 in microfiche Final report, January 1980. 62 p, 17 Fig, 14 Tab, 105 Ref. OWRT-B-018-DEL(3), 14-34-0001-8070.

Descriptors: *Lead, *Cadmium, *Water pollution sources, *Delaware, Automobiles, Storm runoff, Rain gages, Atomic adsorption, Bottom sediments, Solubility, Hydraulic models, Stochastic processes, Water sampling, Adsorption.

A study of the concentrations of cadmium and lead in the Christiana River in the Newark, Delaware, area showed that lead pollution originates from airborne automotive exhausts, while cadmium pollution originates from surface stormwater runoff Four complete storm events were sampled for streamwater degredation analysis at five different sampling stations. Six storms were sampled for rainwater only. Rain-guages consisted of 1000 ml graduated cylinders topped with 8-inch diameter funnels. A portable Beckman pH meter was used for pH determinations and lead and cadmium concentrations were determined by atomic adsorption All streamwater samples were grab samples. Rainwater pH showed a temporal variation for a storm event with increasing pH controlling the lead concentration, while cadmium did not exceed any possible solubility of pH-controlled precipitation Lead was found to be associated with stream sediments while cadmium remained soluble. Stream sediments and soils suspended during a storm event have significant adsorption capacity. Hydraulic dispersion and stochastic models are used to describe stream responses to storm events. (Seigler-IPA
W81-00339

NUTRIENT YIELD OF THE APALACHICOLA RIVER FLOOD PLAIN, FLORIDA: RIVER-QUALITY ASSESSMENT PLAN,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. C. Mattraw, Jr., and J. F. Elder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-103590, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-51, 1980. 21 p, 3 Fig, 1 Tab, 29 Ref.

Descriptors: *Nutrients, *Rivers, *Flood plains, *Wetlands, Detritus, River flow, Sampling, Measurement, Vegetation, Trees, Distribution patterns, Decomposing organic matter, Surface-groundwater relationships, Trace elements, Pesticides, *Florida, Remote sensing, *Apalachicola River(FL), *River quality

The Apalachicola River in northwestern Florida is the location of one of four current U.S. Geological Survey National River Quality Assessments. The investigation of the Apalachicola River and flood plain is designed to quantify the organic detritus and nutrient yield to the productive, estuarine Apalachicola Bay. The extensive riverine flood plain is subject to seasonal flooding which transports large quantities of accumulated, decaying leaf litter from the flood plain into the river and ultimately into Apalachicola Bay. The Apalachicola River Quality Assessment has four major objectives; (1) Determine the accumulation of organic substances and trace elements in benthic organisms and fine-grained sediments; (2) Define the distribution of the major tree communities on the flood plain; (3) Assess the role of leaf fall and decomposition on nutrient yield; and (4) Identify and quantify major sources and pathways of nutrients to the river. Extensive emphasis is given to investigation approaches and techniques to facilitate technology transfer to similar wetland ecosystems. (USGS)
W81-00350

EVALUATION OF A CAVITY-RIDDLED ZONE OF THE SHALLOW AQUIFER NEAR RIVIERA BEACH, PALM BEACH COUNTY, FLORIDA,

Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-00351

A ONE-DIMENSIONAL, STEADY-STATE, DISSOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR THE WABASH RIVER, HUNTINGTON COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Di.
C. G. Crawford, W. G. Wilber, and J. G. Peters.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, paper copy, $7.75, microfiche $3.50. Geological Survey Open-File Report 80-75, January 1980. 55 p, 16 Fig, 3 Plates, 15 Tab, 52 Ref.

Descriptors: *Model studies, *Dissolved oxygen, *Waste assimilative capacity, *Water quality, *Indiana, Streams, Streamflow, Low flows, Reaeration, Water pollution, Waste water disposal, Waste water treatment, Biochemical oxygen demand, Nitrification, Ammonia, Nitrates, Nutrients, Mathematical models, *Huntington County(IN), *Wabash River(IN).

A digital model calibrated to conditions in the Wabash River in Huntington County, Ind., was used to predict alternatives for future waste loadings that would be compatible with Indiana stream water-quality standards defined for two critical hydrologic conditons, summer and winter low flows. The major point-source waste load affecting the Wabash River in Huntington County is the Huntington wastewater-treatment facility. The most significnt factor potentially affecting the dissolved-oxygen concentration during summer low flows is nitrification. However, nitrification should not be a limiting factor on the allowable nitrogenous and carbonaceous waste loads for the Huntington wastewater-treatment facility during summer low flows if the ammonia-nitrogen toxicity standard for Indiana streams is met. The disolved-oxygen standard for Indiana stream, an average of 5.0 milligrams per liter, should be met during summer and winter low flows if the National Pollution Discharge Elimination System's 5-day, carbonaceous biochemical-oxygen demands of a monthly average concentration of 30 milligrams per liter and a maximum weekly average of 45 milligrams per liter are not exceeded. (USGS)
W81-00354

ANALYSES OF WATER, BANK MATERIAL, BOTTOM MATERIAL, AND ELUTRIATE SAMPLES COLLECTED NEAR BELZONI, MISSISSIPPI (UPPER YAZOO PROJECTS),
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary biblic·graphic entry see Field 1B.
W81-00355

A PRACTICAL LAGRANGIAN TRANSPORT MODEL,
Geological Survey, NSTL Station, MS. Water Resources Div.
H. E. Jobson.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225, Paper copy $4.50, microfiche $3.50. Geological Survey open-file report 80-206, 1980. 31 p, 7 Fig, 8 Ref.

Descriptors: *Computer models, *Model studies, *Streamflow, *Riverflow, *Dye releases, Tracers, Tracking techniques, Dispersion, Unsteady flow, Water temperature, Mathematical models, Georgia, *Chattahoochee River(GA), *Transport modeling.

An unconditionally stable and practical transport model for use in upland streams and rivers has been developed and verified. Basing the model on the Lagrangian, rather than the Eulerian, reference frame greatly reduces the numerical problems associated with solving the advective terms of the convective-diffusion equation. The model contains almost no numerical dispersion, is conceptually simple, and is relatively easy to code. Model results closely simulated dye concentrations measured in the Chattahoochee River near Atlanta, Ga. under highly unsteady flow conditions. (USGS)
W81-00360

CONTENT AND DISTRIBUTION PATTERNOF 2, 4-D IN THE RED RIVER,
Saskatchewan Dept. of the Environment, Regina. Inland Waters Directorate.
V. T. Chacko, and W. D. Gummer.
Technical Bulletin No. 115, 1980. 12p, 3 Fig, 13 Ref, 9 Tab.

Descriptors: *Water pollution, *Herbicides, *2, 4-dichlorophenoxyacetic acid, *Contaminants, *Agriculture, *Surveys, *Snalyses, Surface water, Aquatic environment, Red River, Manitoba, Canada, Path of pollutants.

Distribution of the herbicide 2, 4-D in the Red River between Emerson and Netley Lake was studied. The herbicide was found primarily in the water, less on the suspended sediment and not detectable in the bottom sediments and benthos. The recorded high concentration of 2, 4-D in February 1977 that prompted this study is believed to be derived in part from the effluent of the City of Winnipeg's North End Pollution Control Center, which was found to contain 30 500 ng/L 2, 4-D. There is no measurable accumulation of 2, 4-D in the deposited river sediment. This report also addresses (1) the variability of 3, 4-D concentrations attributed to the sampling technique, (2) the river cross-sectional heterogeneity and (3) the sample preservation technique. (WATDOC)
W81-00382

DEVELOPMENT OF AN OIL SPILL MODEL FOR THE ST. LAWRENCE RIVER,
Inland Waters Directorate, Ottawa (Ontario).
M. Fingas, and M. Sydor.
Technical Bulletin No 116, 1980. 25 p, 9 Fig, 32 Ref.

Descriptors: *St. Lawrence River, *Computer models, *Oil spills, *Water pollution, Path of pollutants, Hydrocarbons, Transport, Spill behaviour, Blo-ker's model, Fay's model, Simulation analysis.

The use of modelling to simulate the behaviour of spilled hydrocarbons under varying natural conditions is improving man's understanding of his environment. This report reviews some of the history of oil spill modelling and discusses many of the factors that must be considered in plotting the behaviour of bunker crude oil on the water surface. The report details procedures taken in developing an oil spill simulation model for the St. Lawrence River. (WATDOC)
W81-00386

OCCURRENCE OF HERBICIDE OXADIAZON IN SURFACE WATERS AND TAP WATER,
Kitakyushu Municipal Inst., of Environmental Health Sciences (Japan).
Y. Yamato, and M. Suzuki.
Water Research, Vol 14, No 10, p 1435-1438, October, 1980. 4 Fig, 3 Tab, 13 Ref.

Descriptors: *Surface waters, *Potable water, *Pesticide kinetics, *Oxadiazon, Herbicides, Gas chromatography, Mass spectrometry, Agricultural runoff, Rivers, Reservoirs, Japan, Water sampling, Seasonal, Pesticide residus.

The occurrence of oxadiazon in surface and tap water was investigated by gas chromatographic analyses of water samples taken from one Japanese tap water source, four Japanese rivers, and one Japanese reservoir. Positive identification of oxadiazon was confirmed by mass spectrometry. All samples taken monthly from April to February from the Tonda Reservoir site contained oxadiazon (range, 0.007 ppb in April to 0.304 ppb in August). In tap water, maximum levels of oxadiazon were found in July (0.093 ppb). High concentrations of oxadiazon residues were found after the beginning of rice seedling transplantation at the Higashitani, Nishitani, and Murasaki River sites, (June: 1.1953, 1.156, and 1.075, respectively) after which they rapidly decreased. At the Onga River site, oxadiazon levels ranged from 0.009 ppb in May to 0.445 in July. Oxadiazon residues ranged from 0.001 to 1.953 ppb from all sources tested, with levels in tap water being approximately 3-23% of those in raw water. (Geiger-FRC)
W81-00402

ARSENIC CYCLING IN MARINE SYSTEMS,
Woods Hole Oceanographic Institution, MA.
J. G. Sanders.
Marine Environmental Research, Vol 3, No 4, p 257-266, September, 1980. 2 Fig, 2 Tab, 40 Ref.

Descriptors: *Arsenic compounds, *Continental shelf, *Sediments, *Path of pollutants, Aquatic environment, Rivers, Saline water intrusion, Georgia, Gulfs, Sea water, Atmosphere, Water pollution, Southeast U.S.

The arsenic cycle and recent advances in its study are reviewed with special attention given to the major reactions of arsenic in the continental shelf area of the Georgia Bight. Arsenic is uniformly distributed throughout the marine environment with some concentration in coastal areas due to anthropogenic additions. It occurs naturally in oceans in several oxidation states and often enters into reactions with marine biota. The cycle of arsenic in marine sediments is not well known. The rivers of the southeastern portion of the United States supply little arsenic to the Georgia Bight through runoff waters (10,000 kg/yr according to one investigator). Atmospheric arsenic is a very minor contributor to the arsenic levels of the Georgia Bight (13,000 kg/yr). Diffusion from sediments amounts to 4,800 kg/yr. Arsenic in rainfall in the vicinity of emissions may contain elevated levels of arsenic. The residence time for arsenic in Bight waters is approximately 3 months. Arsenic entering the Bight is largely dissolved as opposed to particulate. The major input of arsenic into the Bight is by way of intrusion subsurface Gulf Stream waters (4 million kg/yr). Changes in arsenic speciation occur by indiscriminate biological uptake involving about 20% of the dissolved arsenate pool and producing measurable levels of methylated and reduced species. Although the overall cycle of arsenic resembles the phosphate cycle, the regeneration period for arsenic is much longer. (Geiger-FRC)
W81-00403

BEHAVIOUR OF HCH (1,2,3,4,5,6-HEXACHLOROCYCLOHEXANE) RESIDUE IN THE AQUATIC ENVIRONMENT,
Kitakyushu Municipal Inst. of Environmental Health Sciences (Japan).
Y. Yamato, M. Suzuki, K. Shimohara, and T. Akiyama.
Water Research, Vol 14, No 3, p 247-251, March, 1980. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Surface waters, *Pesticide kinetics, Gas chromatography, Rivers, Reservoirs, Agricultural runoff, Persistence, Runoff forecasting, Sampling, Seasonal, Water pollution sources.

Knowledge of the behavior of organochlorine pesticides in surface waters is helpful in evaluating the contamination of field soils with these components. To this end, surface water samples taken monthly for 1 yr from five sites in Japan representing three rivers and one reservoir were analyzed for levels of 1,2,3,4,5,6-hexachlorocyclohexane (HCH) by gas liquid chromatography. Equations of the waves derived from plotting log concentrations of HCH against time were calculated from monthly variations at each sampling site. At all five sites, HCH was found in higher levels during the summer and at lower concentrations in the winter. At the river sites, maximum HCH concentration was found in August. This was thought to be due to HCH residing in paddy field soils that flowed out with repeated flooding. Of all the sampling sites, the amplitude of the wave described by the data from the reservoir was the smallest. The slope of the wave at a downstream sampling site was smaller than that at a site upstream on the same river. Projected maximum total HCH concentra-

tions for 1985 show that levels at the upper stream will be about a hundredth or a thousandth of those downstream. Estimates for the five sites for 1985 ranged from .0000015 to .003 ppb HCH. Equations also showed that beta-HCH was more persistent than gamma-HCH in surface water. Estimates for 1985 indicated that the ratio of beta-HCH to total HCH in surface water would be approximately 60%. (Geiger-FRC)
W81-00410

MOVEMENT OF 2,4,5-T THROUGH LARGE SOIL COLUMNS,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
G. A. O'Connor, P. J. Wierenga, H. H. Cheng, and K. G. Doxtader.
Soil Science, Vol 130, No 3, p 157-162, September, 1980. 7 Fig, 16 Ref.

Descriptors: *2,4,5-T, *Soil water movement, *Tritium, *Computer models, Chlorinated hydrocarbon pesticides, Herbicides, Pesticides, Clay loam, Soils, Pesticide kinetics, Adsorption, Biodegradation, Flow, Sorption, Greenhouses, Path of pollutants, Irrigation.

The movement of tritiated waters and 2,4,5-T, an herbicide, through large soil columns was investigated. Adsorption in Glendale clay loam conformed to the Freundlich relationship up to an equilibrium herbicide concentration of about 20 micrograms/ml. Desorption studies indicated more hysteresis than previously reported. Degradation studies confirmed the relatively slow biological degradation of 2,4,5-T previously reported. One study indicated that 2,4,5-T applied at 80 micrograms/ml remained in Glendale soil for about 85 days in large soil columns under similar greenhouse conditions. Predicted and observed tritium concentrations in both the effluent and inside the column were used to evaluate the ability of a computer model to simulate transient state water flow in soil. The model incorporated both the adsorption-desorption and biological degradation processes. The model successfully predicted tritiated water distributions after several irrigations. Predicted and observed distribution of the herbicide over the first few days were closely similar, indicating the effectiveness of the model. Movement of the sorbable herbicide was retarded in relation to the movement of the water in which it was dissolved. However, movement of the herbicide through the soil after the second and third irrigations was not adequately described by this model. No 2,4,5-T was found in the drainage from the soil columns. (Baker-FRC)
W81-00411

LEACHING LOSSES OF TWO NUTRIENTS AND AN HERBICIDE FROM TWO SANDY SOILS DURING TRANSIENT DRAINAGE,
Florida Univ., Gainesville. Dept. of Soil Science.
R. S. Mansell, W. B. Wheeler, and D. W. Calvert.
Soil Science, Vol 130, No 3, p 140-150, September, 1980. 8 Fig, 5 Tab, 13 Ref.

Descriptors: *Potassium, *Nitrogen compounds, *Herbicides, *Leaching, *Sprinkler irrigation, Pesticides, Irrigation, Flow, Subsurface waters, Drainage, Soil water, Cultivation, Rainfall, Nutrients, Nitrates, Nitrification, Water table, Soil types, Acid soils.

Shallow-tilled (ST) and deep-tilled (DT) plots of an acid, sandy soil were used to measure changes in potassium, nitrogen nitrates, and Terbacil concentrations in subsurface drainage water from the plots. Fertilizer (equivalent to 35.18 kg/ha K, 19.07 kg/ha NO3-N, and 23.31 kg/ha NH4-N) and Terbacil herbicide (4.5 kg/ha) was applied to the soil. Transient water flow was applied to the plots for a 2-wk period after 7.6 cm of irrigation had been achieved. Rainfall occurred 10, 11, and 12 days after fertilizer and Terbacil application (total water, 4.8 cm). ST drainage water contained higher concentrations of all solutes than did DT drainage water. In ST soils, the water table rose to within 100 cm of the surface during sprinkler applications of water, whereas in DT the water table rose to within 60 cm. In the DT soil, the discharges of potassium, nitrogen producing nitrates, and Terbacil were only 29.6, 37.0, and 13.9%, respectively as large as those in the ST soil. This was due to the slower drainage, higher soil-water contents, and higher clay content and organic matter present in the upper 60 cm of the DT soil. Total cumulative drainage from DT soil was only 51.1% that from ST soil. Thus, relatively small quantities of irrigation and rainfall produced relatively large nutrient discharges. As irrigation was begun soon after fertilizer application, the leaching loss of these solutes would be expected to be greater than if water application had occurred later. (Baker-FRC)
W81-00414

BEHAVIOUR OF 12 INSECTICIDES IN SOIL AND AQUEOUS SUSPENSIONS OF SOIL AND SEDIMENT,
Malaysian Agricultural Research and Development Inst., Selangor.
M. S. Sharom, J. R. W. Miles, C. R. Harris, and F. L. McEwen.
Water Research, Vol 14, No 8, p 1095-1100, August, 1980. 6 Fig, 4 Tab, 15 Ref.

Descriptors: *Sediments, *Soils, *Pesticide kinetics, *Insecticides, *Path of pollutants, Chlorinated hydrocarbon pesticides, Organophosphorus pesticides, Leaching, Carbamate pesticides, Adsorption, Stream erosion, Soil types, Organic soils, Loam, Sands, Absorption, Solubility, DDT, Dieldrin, Diazinon

Pesticides and their degradation products may enter the aquatic environment by leaching directly to streams or ground waters or by erosion of contaminated soils into streams. Once in an aquatic environment, the more adsorptive compounds will adhere to the sediments. The behavior of 12 insecticides representing the organochlorine, organophosphorus, and carbamate groups was tested in soil and in aqueous suspensions of soil and a stream sediment under laboratory conditions. Adsorption onto soil followed the order DDT > leptophos > dieldrin > endrin > ethion > chlorpyrifos > lindane > parathion > diazinon > carbaryl > carbofuran > mevinphos. The absorption of insecticides to soil or sediment was in general inversely correlated with the solubility of the insecticide in water. The absorptive capacity of the soils and sediments for the insecticides followed the order organic soil > stream sediment > Beverly sandy loam > Plainfield sand. Mobility and desorption of insecticides was found to increase with the solubility of the insecticide in water. These findings indicate that the water solubility properties of the insecticide and the nature of the adsorbents play a greater role than compound structure in determining the adsorption, desorption, and mobility behavior of an insecticide in soil and water. (Geiger-FRC)
W81-00499

5C. Effects Of Pollution

ENVIRONMENTAL IMPACT OF A NUCLEAR PLANT ON MISSISSIPPI RIVER BIOTA IN AN ECOLOGICAL RECOVERY ZONE NEAR RED WING, MINNESOTA,
Saint Mary's Coll., Winona, MN. Dept. of Biology.
L. J. Dieterman, and D. R. Mc Conville.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120610. Price codes: A13 in paper copy, A01 in microfiche. Final Report submitted to Office of Water Research and Technology (1980), 269 p, 55 Fig, 66 Tab. OWRT-C-4343(No 9051)(1), 14-31-0001-9051.

Descriptors: *Thermal pollution, *Biota, Water pollution, Telemetry, Fluorometry, *Fish behavior, *Mississippi River, Fish movement, Population dynamics, Phyto-, Benthos, Macrophyte, *Nuclear powerplants, *Minnesota, Red Wing(MN).

The biota of the Mississippi River in an ecological recovery zone near Red Wing, MN was studied before and after start-up of a nuclear plant to acquire baseline data and to estimate changes due to thermal addition. Thermal addition produced significant decreases in primary production in a plant region during summer month periods when water temperatures were near 36 degree C. Other regions were not affected due to eutrophic waters and efficient mixing of large water volumes. Extensive fisheries studies and sonar tagging/tracking of S. vitreum were performed. Comparison of fisheries results with other riverine, lake, and pond studies indicated a favorable environment for the success of the fish species studied. Qualitative macroinvertebrate surveys were conducted. The area supports a large and diverse macroinvertebrate community characteristic of a healthy freshwater stream. River modifications in the recycle canals produced a unique acquatic ecosystem. Macroinvertebrate population differences in this region were noted.
W81-00262

IMPACT OF IRON DISCHARGES FROM WASTEWATER TREATMENT PLANTS ON ALGAL GROWTH AND SPECIES COMPOSITION,
State Univ. of New York Coll. at Fredonia. Environmental Resources Center
T. A. Storch, and V. L. Dunham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120602, Price codes: A06 in paper copy, A01 in microfiche. Center for Environmental Research, Cornell University, Ithaca, New York. Completion Report, October 1980. 104 p, 40 Fig, 19 Tab, 36 Ref. OWRT-B-074-NY(2), 14-34-0001-8102.

Descriptors: *Algae, *Chlorophyts, Algal bioassays, Algal metabolism, Blue-green algae, Green algae, *Iron, Nitrogen metabolism, Nitrification, Photosynthesis, Community composition, *Waste water(Pollution), Effects, Plant growth, *Phytoplankton, *Lake Erie, *Chautauqua Lake(NY), Anabaena flos-aquae, Scenedesmus bijugatus, Selenastrum capricornutum, Nitrate reductase, Nitrite reductase, Glutamine synthetase.

Unialgal cultures and lake assemblages of phytoplankton were studied to determine the effect of iron enrichment on algal metabolic processes and community composition. Phytoplankton assemblages from Lake Erie and Chautauqua Lake, N.Y. were generally inhibited following enrichment with unchelated iron. The degree of inhibition in lake water was small and it occurred as a result of extracellular interactions between iron and soluble ions (phosphorus and possibly some trace metals). Increases in photosynthesis following the addition of EDTA-chelated iron to lake water was shown to result primarily from the effect of EDTA alone on algal metabolism. Lake diatom populations appeared to be the most sensitive to iron. However, iron enrichment did not enhance lake populations of blue-green algae nor did it cause major shifts in the composition of the phytoplankton community. Investigations with defined nutrient media indicated that iron enrichment stimulated the growth of unialgal cultures primarily only in nutrient-rich media. Under iron limiting conditions, iron enhanced cellular growth, photosynthesis and chlorophyll a content in both green and blue-green algae. Iron also stimulated the enzymes (nitrate and nitrite reductase and glutamine synthetase) involved in nitrogen metabolism in blue-green algae, but inhibited their activity in green algae. Iron was also observed to be important in the early stages of heterocyst formation by blue-green algae.
W81-00265

LAKE SAMMAMISH RESPONSE TO WASTEWATER FIVERSION AND INCREASING URBAN RUNOFF,
Washington Univ., Seattle. Dept. of Civil Engineering
For primary bibliographic entry see Field 2H.
W81-00274

EFFECTS OF WATER-BORNE MIREX ON THE SURVIVAL AND PRODUCTION OF MACROBRACHIUM ROSENBERGII (DE MAN),
Clemson Univ., SC
A. G. Eversole.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124091, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Clemson University. Technical Report No 88, June 1980. 44 p, 6 Fig, 16 Tab, 29 Ref. OWRT-B-115-SC(1).

Descriptors: *Water pollution effects, *Aquiculture, *Pesticides, *Crustaceans, Bioassay, Gas chromatography, Pesticide toxicity, *Mirex, Prawns, Macrobrachium rosenbergii, Chlorinated hydrocarbons, Shrimp.

Water-borne mirex, in concentrations above 100 microg/l, was lethal to postlarval Macrobrachium rosenbergii in a 24-hour exposure acute toxicity experiment. Adult and juvenile prawns did not show a clear relationship between survival and concentration when exposed to mirex in water for 24 hours. Postlarvae exposed to mirex in water for 96 hours, with 10 prawns per test container, exhibited reduced survival with increasing mirex concentration. Individually exposed postlarvae (96 hours) did not exhibit such a distinct mortality pattern. A significant increase in length of molt intervals with increasing concentration was found for postlarvae individually exposed to mirex in water for 96 hours. Potential production figures, calculated from data for prawns individually exposed indicate an increase in production (wet weight) of controls 2.24 and 1.70 times that of prawns exposed to 100 and 10 microg/l, respectively. Mirex residues in the tested postlarvae generally increased with increasing mirex concentration. Residues of mirex in postlarvae exposed to mirex for 24 hours (no food was present during the exposure period) suggest that M. rosenbergii can absorb mirex from the surrounding water. Water samples showed a marked decrease in mirex residues after 96 hours.
W81-00326

SECONDARY FIBRES PULPING/DEINKING EFFLUENT TOXICITY STUDY,
Beak Consultants Ltd., Vancouver (British Columbia).
Environmental Protection Service, Ottawa, Ontario, Canada, Water Pollution Control Directorate.
Economic and Technical Review Report EPS 3-WP 79-6, 1979. 37 p, 16 Tab, 22 Ref.

Descriptors: *Pulp wastes, *Effluents, *Analyses, *Bioassay, *Toxicity, Heavy detergents, Pulp washing(Deink), Characteristics, Treatment, Sampling, Canada.

The effluents from five integrated secondary fibre pulping (SPP)/deinking mills located in the north mid-western United States and Eastern Canada were sampled for toxicity during the period November 1977 to February 1978. The untreated effluent from the SFP/deinking mills was found to be toxic and it was determined that the toxicity was contributed by the pulp washing (deinking) effluent stream. Contributors to toxicity found in the deinking effluent included: fibre, alkaline pH, polychlorinated biphenyls (PCBs), heavy metals and detergents. No correlation was established between changes in the individual toxicant concentrations and the variations in effluent toxicity. The pulp washing stream contained both a foam and a liquid fraction. The foam fraction exhibited much higher toxicity and contained higher concentrations of toxicants than the liquid portion. Settling of the pulp washing effluent prior to bioassay testing reduced toxicity, while setting of the untreated toal mill effluent did not significantly reduce toxicity. The deinking process is fully described, as are the defibering processes at each mill. A brief review of the literature is also presented. (WATDOC)
W81-00388

THE POTENTIAL FOR NITROGEN FIXATION IN A LAKE RECEIVING SEWAGE EFFLUENT (GRASMERE, ENGLISH LAKE DISTRICT),
Freshwater Biological Association, Ambleside (England).
K. L. Jones, J. V. Roscoe, and J. G. Jones.
Journal of Applied Bacteriology, Vol 49, No 1, p 143-154, August, 1980. 6 Fig, 3 Tab, 37 Ref.

Descriptors: *Water sampling, *Lakes, *Sewage effluents, *Nitrogen fixing bacteria, Sediments, Seasonal, Nitrogen, Dissolved oxygen, Epilimnion, Hypolimnion, Cores, Nitrogen fixation, Thermal stratification, Ammonium compounds, Reduction(Chemical), Water pollution, Analytical techniques.

The potential for nitrogen fixation in the sediment and water column was studied at three sites in Grasmere, a lake in the English Lake District. The light-independent acetylene-reduction technique was employed for samples taken at different seasons, and at sites with varying levels of inorganic nitrogen and dissolved oxygen in the epilimnion and hypolimnion. Most probable number (MPN) counts of nitrogen fixing bacteria were carried out on glucose-supplemented medium for non-photosynthetic organisms and on ASM medium for cyanobacteria. Differences within a sediment core and between cores, and the method and medium for MPN determinations of potential nitrogen fixers were studied in preliminary investigations. Good correlations were found between potential rates of nitrogen fixation and MPN counts of nitrogen-fixing bacteria and between these parameters and decreases in levels of dissolved oxygen. During the period of thermal stratification, selective changes in the nitrogen-fixing microflora seemed to occur. Light-dependent fixation and cyanobacteria were undetectable in the water column. Acetylene reduction was found for most of the season in samples of water and sediment to which a carbon and phosphorus source have been added. It was concluded that sewage effluent has changed the nitrogen cycle and suppressed nitrogen fixation in Grasmere by increasing the level of ammonium throughout the lake, and by general enrichment. (Geiger-FRC)
W81-00404

VARIABILITY IN MICROBIOLOGICAL DATA FROM A STRATIFIED EUTROPHIC LAKE,
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 2H.
W81-00405

CANCER INCIDENCE AND TRIHALOMETHANE CONCENTRATIONS IN A PUBLIC DRINKING WATER SYSTEM,
Arkansas Univ. Medical Sciences Campus, Little Rock. Div. of Biometry.
G. L. Carlo, and C. J. Mettlin.
American Journal of Public Health, Vol 70, No 5, p 523-525, May, 1980. 2 Tab, 1 Ref.

Descriptors: *Potable water, *Chlorination, *Public health, Municipal water, Halomethanes, Cancer, New York, Water supply, Water sources, Groundwater, Surface waters, Water quality, Toxins, Epidemiology.

Consideration was given to 4,255 cases of esophageal, stomach, colon, rectal, bladder, and pancreatic cancers reported in Erie County to the New York State Tumor Registry between 1973 and 1976. A relationship was sought between cancer incidence and the concentration of trihalomethanes, by-products of chlorination, present in the various drinking water supplies. Control variables were socio-economic status, mobility, percent nonwhite, and urbanicity. Water source was divided into two types: surface (lake, river, reservoir) and ground (well, spring). A positive association was found between surface water as the source of supply and the incidence of esophageal and pancreatic cancer (Pearson correlation coefficient, r, $= -0.16$, $p < 0.05$). A positive correlation was also found between concentrations of trihalomethanes and the incidence of pancreatic cancer among white males ($p < 0.05$). However, for the total population studied, levels of trihalomethanes were not correlated with cancer incidence of any site. (Baker-FRC)
W81-00406

MUTAGENIC ACTIVITY IN DRINKING WATER,
Tulane Univ., New Orleans, LA. Dept. of Environmental Health Sciences.
N. Gruener, and M. P. Lockwood.
American Journal of Public Health, Vol 70, No 3, p 276-278, March, 1980. 1 Tab, 10 Ref.

Descriptors: *Potable water, *Mutagens, *Carbon, Total organic carbon, Laboratory tests, Laboratory animals, Public health, Municipal water, Cytological studies, Louisiana, Toxins, Water pollution sources, Water quality.

Samples of New Orleans tap water were concentrated through freeze drying, and the mutagenic and promoting activities of the water were tested by exposing Chinese hamster embryonic lung cells (V79) to the concentrated water for 2 hr. After exposure, cytotoxicity was determined by a reduction in plating efficiency compared with acetone-treated controls. Water samples containing only 140 mg/liter of total organic carbon (TOC) caused no mutagenic activity. However, a dose of 480 micrograms TOC from New Orleans drinking water caused a mutation frequency of 7.1 mutants/million surviving cells. It was calculated that the average daily intake of TOC through drinking water in New Orleans is 3,000 micrograms. Cells exposed to the potent promoter 12-O-tetradecanoyl-phorbol-13-acetate prior to exposure to the water demonstrated increased mutation frequencies. Tests on the water itself showed it to enhance benzo(a)pyrene mutagenicity approximately 100%. This may indicate that chemicals contaminating water can enhance carcinogenicity of other environmental factors such as air pollutants. The finding that water contains compounds which can directly or indirectly affect cellular DNA should be considered when bioassay carcinogenicity tests are designed. While these tests do consider the diet of the animals being studied, a little or no attention is given to the purity of their drinking water. (Baker-FRC)
W81-00408

LAKE WEEDS CAN BE CONTROLLED,
K. Grover.
American City and County, Vol 95, No 3, p 63-65, March, 1980. 4 Fig.

Descriptors: *Aquatic weed control, *Lakes, *Eutrophication, *Aging(Biological), Nutrients, Sewerage, Phosphates, Settling basins, Dams, Watershed management, Dredging, Weeds, Harvesting, Drawdown, Water levels, Nitrogen, Water pollution control, Herbicides, Farm ponds.

d control is to limit the nutrients entering a lake. While effective watershed management practices, including proper sewering, limited use of phosphates, and the development of siltation settling ponds and dams, will decrease the nutrient supply, these steps are not the major answer. At Vandalia, Missouri, dredging was used to remove 80,000 cu yards of silt and weeds in the city reservoir. Dredging at Long Lake, Michigan removed 840,000 cu ft of sediment, killed all weeds and improved recreational water uses. Problems involve cost and disposal of dredge spoil. Five cutters, eight weed transports and support machinery harvest 7,000-8,000 acres of water weeds each year in Dane County, Wisconsin. Lake level drawdown at Black Lake, Louisiana achieved 100% control of elodea and 78-100% control of fanwort. The use of herbicides is controversial. In Missouri, dichlobenil controlled weeds in farm ponds, but also caused a 70-100% increase in nitrogen and phosphorus concentrations due to decomposition of vegetation. Sediment covers placed on the bottom of lakes have been effective and provide immediate control. Biological control has been achieved through the use of snails, crayfish or the white amur. (Baker-FRC)
W81-00418

RESPIRATION OF AQUATIC INSECT LARVAE (EPHEMEROPTERA, PLECOPTERA) IN ACID MINE WATER,
Ohio Univ., Athens. Dept. of Zoology.
F. G. Doherty, and W. D. Hummon.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 358-363, September, 1980. 2 Tab, 19 Ref.

Descriptors: *Mayflies, *Stoneflies, *Acid mine water, *Respiration, Oxygen requirements, Toxicity, Mine wastes, Aquatic insects, Larvae, Water pollution effects.

Two species of Ameletus mayfly larvae (Ephemoroptera) and stonefly larvae (Plecoptera; Acroneuria xanthenes) were exposed to acid mine water for a period of 3 hr to measure the mine water's effect on oxygen consumption and respiratory rate. Median lethal time (LT50) values were determined by probit analysis, and oxygen consumption/hr was measured by calculations of regression coefficients by least squares. LT50 was 21.4 hr for A. lineatus and 29.0 hr for both Ameletus species. In each species the log transformation of oxygen consumption (microliters O2/g hr) was found to decrease with increasing individual dry weight. Oxygen consumption/unit weight, represented by a regression coefficient, differed from zero only for A. lineatus and A. xanthenes. Statistical comparisons betweeen regression coefficients obtained from sequential measurements of respiratory rates on solitary individuals showed that a majority of larvae exhibited similar rates regardless of the solution (control or acid mine water) to which they were exposed for second rate determinations. Intervention in the respiratory process by extraneous factors out of the scope of this experiment was suspected. Rates of osygen consumption for control and acid waters without test animals were negligible, showing the absence of bacterial contamination. It is concluded that the toxic mode of action of acid mine water did not operate through mechanisms that can be measured by respirometry (Geiger-FRC)
W81-00420

AMMONIUM INPUT TO THE SEA VIA LARGE SEWAGE OUTFALLS-PART I: TRACING SEWAGE IN SOUTHERN CALIFORNIA WATERS,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
W. H. Thomas, and A. J. Carsola.
Marine Environmental Research, Vol 3, No 4, p 277-289, September, 1980. 6 Fig, 1 Tab, 19 Ref.

Descriptors: *Ammonium compounds, *Phytoplankton, *Outfall sewers, *Tracking techniques, Sea water, On-site tests, Waste dilution, Pollutant identification, Coliforms, Turbidity, Chlorination, Baseline studies, Dissolved oxygen, Sewage treatment, Effluents, Water pollution sources, California, Sewage effluents.

High ammonium concentrations were found in sea water near large sewage outfalls off Southern California. This nutrient has potential use as a tracer of sewage discharge. Samples from seven or more depths were taken seasonally and monthly near three sewage outfalls. Turbidity, prevailing currents, and routine water quality parameters were measured. In June-July, ammonium levels were significantly higher than control levels (Camp Pendleton) at the White Point Outfall (30.2 mg-atom/sq m, 539% of control). In September-October, levels were significantly higher than the control at Hyperion Outfall (27.9 mg-atom/sq m, 3,390%) and Point Loma Outfall (5.3 mg-atom/sq m, 757%). In January-February, the corresponding figures were 85.6 mg-atom/sq m (465%) at Hyperion and 64.1 mg-atom/sq m (348%) at Point Loma. High ammonium levels were found associated with turbid layers, prevailing currents, detectable coliform bacteria (in one case only), and undersaturated dissolved oxygen concentrations. In addition, high concentrations of ammonium are associated with slowed phytoplankton assimilation rates linked to the inhibition of phytoplankton growth in outfall receiving waters. Use of ammonium as a tracer could also indicate the degree of dilution of sewage. However, it is dependent on adequate analytical methods and on sewage which has not received secondary treatment. (Titus-FRC)
W81-00426

AMMONIUM INPUT TO THE SEA VIA LARGE SEWAGE OUTFALLS - PART 2: EFFECTS OF AMMONIUM ON GROWTH AND PHOTOSYNTHESIS OF SOUTHERN CALIFORNIA PHYTOPLANKTON CULTURES,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
W. H. Thomas, J. Hastings, and M. Fujita.
Marine Environmental Research, Vol 3, No 4, p 291-296, September, 1980. 2 Tab, 11 Ref.

Descriptors: *Ammonium, *Dinoflagellates, *Phytoplankton, *Sea water, *Eutrophication, *Chlorination, Heavy metals, Growth rates, Photosynthesis, Laboratory tests, Marine algae, Toxicity, Diatoms, Outfall sewers, Effluents, California, Water pollution sources, Sewage effluents.

Tests were conducted on the effects of ammonium concentrations on the growth of six marine phytoplankton from Southern California which might be exposed to high ammonium levels in water near sewage outfalls, particularly the Whites Point outfall. Ammonium in concentrations up to 200 microgram-atom/liter was added to cultures of three diatoms (Asterionella japonica, Skeletonema costatum, Chaetocerus affinis), two dinoflagellates (Gymnodinium splendens, Gonyaulax polyedra), and an organism of the Dunaliella species. At concentrations of 150 and 200 microgram-atom/liter, growth rates were inhibited in the two dinoflagellate cultures. Photosynthesis was inhibited in Gymnodidium splendens at 100 and 200 microgram-atom/liter. This dinoflagellate is noteworthy as part of the anchovy food chain. Other phytoplankton were virtually unaffected. Levels of ammonium near sewage outfalls were found to lie mostly between 10 and 30 microgram-atom/liter, which would not inhibit phytoplankton growth. It is hypothesized that other factors such as heavy metals or chlorine compounds associated with chlorinated sewage may inhibit phytoplankton growth, and that ammonium may even be a factor contributing to eutrophication near sewage outfalls. (Titus-FRC)
W81-00427

POSSIBLE EFFECTS OF PHOSPHORUS ON ALGAL GROWTH IN BARTON BROAD AND RELATED CONTROL MEASURES,
Anglian Water Authority (England). Norfolk and Suffolk River Div
M. G. W. Bell, and F. H. Jones.
Water Pollution Control, Vol 79, No 2, p 177-194, 1980. 5 Fig, 10 Tab, 19 Ref.

Descriptors: *Phosphorus, *Nutrient removal, *Algal control, *Lakes, Eutrophication, River systems, Inland waterways, Sewage treatment, Water pollution control, Sewage effluents, Treatment facilities, Agricultural runoff, Bottom sediments.

Attempts to reduce the phosphorus levels in Barton Broad, Norfolk, England to a concentration which would support the coexistence of algae and higher plants are described. Barton Broad lies in the valley of the River Ant. Macrophyte growth in this broad has been attributed to eutrophication and dense phytoplankton blooms. Sewage effluents and drainage from agricultural lands provide nutrients to Barton Broad via the River Ant, however, these sources do not account for the 1,300 kg/yr of phosphorus which reaches the Broad. It was suggested that phosphorus entered from river beds, and studies to ascertain this were undertaken. Increased dissolved phosphorus levels were detected in bottom muds and were believed to be due to discharges from the sewage effluent sources at Stalham and North Walsham Sewage Treatment Works. Measurements of annual loadings of phosphorus at both sites indicated that reduction of phosphorus discharge at each site would be necessary to attain the target steady-state level of 100 micrograms P/liter in the Broad. The Stalham works were upgraded for increased phosphorus removal by using ferric sulfate, while innovations at the North Walsham plant were deferred in lieu of future plans for possible sea discharge. Over 90% phosphorus removal was achieved at Stalham, but the frequent monitoring required by the upgraded process will require further work. Discussions on phosphorus control work in the Broad follow this article. (Geiger-FRC)
W81-00430

THE WATER-FERN SALVINIA MOLESTA IN THE SEPIK RIVER, PAPUA NEW GUINEA,
Office of Environment and Conservation of Papua New Guinea, Port Moresby.
D. S. Mitchell, T. Petr, and A. B. Viner.
Environmental Conservation, Vol 7, No 2, p 115-122, Summer, 1980. 4 Fig, 4 Tab, 15 Ref.

Descriptors: *Ferns, *Aquatic weeds, *Lakes, *Lagoons, Nutrients, Phosphorus, Nitrogen, Rivers, Aquatic plants, Water resources development, Water pollution, Water pollution control, Fishkill, Governments, United Nations, Asia, Aquatic weed control.

The backwaters of the Sepik River between Pagwi and Angoram in Papua New Guinea have been heavily overgrown since 1977 with Salvinia molesta, an exotic water-fern that was introduced into the area in the early 1970s. Salvinia covered approximately 80 sq km by May of 1979 and the physico-chemical properties of lagoons and lakes of the Sepik River were investigated to determine the effects of nutrients on the ferns. Dissolved nitrogen and phosphorus did not show extreme concentrations when compared with other waters but did show an influence from Salvinia and other aquatic plants. Dissolved phosphate-phosphorus was only about 25% of that on the open Sepik near or under weed beds, while nitrate nitrogen values near or under weed beds were only about 10% of those of the open river. Examinations of the silt load of the Purari River to the south showed available phosphate phosphorus for plant metabolism. Overgrowth of Salvinia has caused declines in Saltfish Tilapia (Sarotherodon mossambicus) fisheries, crocodile hunting, and sago-palm collection. Blockage of waterways has hindered transportation and the development of tourism. Programs to manage the growth of Salvinia are being conducted by local, provincial, and central government and the United Nations; however, the complete elimination of the weed from the backwaters of the Sepik River does not seem likely. The overgrowth of the fern illustrates the danger of introducing exotic species into alien environments. (Geiger-FRC)
W81-00431

UPTAKE OF TRACE METALS BY THE CLAM MACOMA INQUINATA FROM CLEAN AND OIL-CONTAMINATED DETRITUS,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Research Lab.
E. A. Crecelius, J. M. Augenfeld, D. L. Woodruff, and J. W. Anderson.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 337-344, September, 1980. 3 Fig, 3 Tab, 7 Ref.

Descriptors: *Clams, *Oil pollution, *Trace elements, *Sea water, Water pollution, Radioisotopes, Neutron activation analysis, Suspended solids, Aquatic animals, Metals, Chromium, Cobalt, Iron, Zinc, Detritus.

Clams (Macoma inquinata) were exposed to clean and oil-contaminated neutron-activated detritus (suspended matter in Sequim Bay water settled out in a laboratory flowing sea water system) for periods of 2, 4, 8 and 15 days to measure the uptake of tract metals by marine detritivors. After 15 days of exposure, depuration of the remaining clams was carried out in tanks filled with clean water and non-labeled detritus for 2 or 8 days. Uptake of Cr-51, Co-60, Eu-152, Fe-59, Sc-46, and Zn-65 was measured in clams and adjusted according to the rate of decay for each isotope to account for the time each sample was removed from the exposure tank. No difference was found in the quantity of Co released to sea water by oiled and non-oiled sediments. Co was the only metal which appeared consistently in sea water and clam shells at detectable levels. Cr, Eu, and Sc appeared in sea water sporadically, while Fe and Zn were not detected at all. Clams transferred to tanks with non-labeled detritus quickly lost radioactive material so that only 1-10% of the original radioactivity remained after 8 days. Cr was found in only three clam samples. Eu was not absorbed from the gut, and no evidence was found of Fe uptake. In general, less oiled than non-oiled detritus was ingested, making smaller amounts of labeled metal available for absorption across the walls of the intestinal tract.

There was no evidence that more Co was taken into the shells from oiled than from non-oiled detritus. (Geiger-FRC)
W81-00434

EFFECTS OF ROUNDUP HERBICIDE ON POPULATIONS OF DAPHNIA MAGNA IN A FOREST POND,
Northwest Ecological Animal Research Ltd., Vancouver (British Columbia).
L. D. Hildebrand, D. S. Sullivan, and T. P. Sullivan.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 353-357, September, 1980. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Daphnia, *Ponds, *Herbicides, Toxins, Toxicity, Aquatic animals, Aquatic life, Water pollution, Water pollution effects, Pesticides, Defoliants, Forests.

The toxicological effects of a range of concentrations of Roundup herbicide on populations of Daphnia magna were studied in a forest pond. Roundup is a commercial formulation containing 356 g/liter present as isopropylamine salt, and enters bodies of water through defoliation of vegetation in the treated area. The experimental pond measured 60 by 24 m and reached depths of 3-4 m. Plastic and nylon cylindrical pens (15 cm in diameter, 35 cm high) containing D. magna were suspended at four stations in the pond, each of which was treated with one of the following doses: 0 (control), field dose (2.2 kg/ha), 10x field dose, and 100x field dose. Population samplings were made on days 2, 4, and 8 after herbicide application. Herbicide treated D. magna populations showed no differences from control populations for all doses and exposure times examined (92-100% survival rate). The high survival rates of D. magna exposed to Roundup suggest that this herbicide had no detectable effect on this organism. (Geiger-FRC)
W81-00435

RELATIONSHIP OF PER CENT MORTALITY OF FOUR SPECIES OF AQUATIC BIOTA FROM 96-HOUR SEDIMENT BIOASSAYS OF FIVE LAKE MICHIGAN HARBORS AND ELUTRIATE CHEMISTRY OF THE SEDIMENTS,
Aqua Tech Environmental Consultants, Inc., Melmore, OH.
R. A. Hoke, and B. L. Prater.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 394-399, September, 1980. 4 Fig, 10 Ref.

Descriptors: *Biota, *Lake Michigan, *Sediments, *Mortality, Chemical analysis, Bioassay, Correlation analysis, Chlorides, Ammonia, Nickel, Aquatic life, Daphnia, Sampling, Dredging, Waste disposal, Toxicity.

Sediment grab samples were collected from five Lake Michigan harbors and were analyzed using bulk and elutriate chemical techniques as well as 96-hour sediment bioassays on four aquatic species. Bivariate correlations between the percent mortalities of Pimephales promelas, Hexagenia limbata, Lirceus fontinalis, and Daphnia magna and elutriate chemical data were performed by computer analysis. Of 60 bivariate correlation analyses conducted, 4 met the criteria established to identify a relevant correlation ($r = or > 40$, $p = 0.05$). The mortality of P. promelas was significantly correlated with the elutriate levels of chloride, and the mortality of H. limbata was significantly correlated with the elutriate levels of chloride, ammonia, and nickel. Previous investigations have shown greater numbers of significant correlations between mortality of test organisms and bulk chemistry of the sediments, suggesting that bulk sediment chemistry and bioassays may be more appropriate in assessing the impact of dredged material disposal on benthic species. (Geiger-FRC)
W81-00436

MASS FRAGMENTOGRAPHIC DETERMINATION OF POLYMETHYLNAPHTHALENE AND POLYMETHYLPHENANTHRENE IN A CRUDE OIL AND IN MARINE ORGANISMS,
Hyogo Prefecture Public Health Inst., Kobe (Japan).
For primary bibliographic entry see Field 7B.
W81-00437

TOXICITY OF A FUEL OIL TO THE EGGS OF PARHYALE HAWAIENSIS AND AMPHITHOE VALIDA (AMPHIPODA),
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
W. Y. Lee, and J. A. C. Nicol.
Marine Environmental Research, Vol 3, No 4, p 297-305, September, 1980. 3 Fig, 1 Tab, 22 Ref.

Descriptors: *Amphipoda, *Oil, *Embryonic growth stage, *Juvenile growth stage, Toxicity, Growth stages, Mortality, Aquatic animals, Crustaceans, Water pollution, Oil pollution, Marine animals.

The toxicity of fuel oil to developing embryos and juveniles was studied in two marine amphipods, Parhyale hawaiensis and Amphithoe valida. Eggs of P. hawaiensis were selected at both early and late embryonic stages. Four concentrations (10, 20, 30, and 40%) of the water-soluble fraction (WSF) of No. 2 fuel oil were tested. For studies with A. valida, females bearing eggs in an early stage of development were exposed to concentrations of 10, 20, and 30% WSF. After 5 days, the females were sacrificed and the eggs examined for any changes indicative of fuel-oil toxicity. Eggs of P. hawaiensis were able to develop from early germinal disc stage to juvenile form in concentrations of WSF up to 40%. Among early eggs, there was greater mortality of embryos in WSF concentrations of 10-30% ($p < 0.01$); among late eggs, survival of embryos and juveniles was much greater (75% of eggs in 40% WSF hatched). However, compared with the control, there was a reduction in survival of late eggs at 30 and 40% WSF ($p < 0.01$). Juveniles hatched from early eggs died, mortality increasing with 20% WSF and above, and, at 40% WSF, no early eggs hatched. Toxicity varied with concentration and length of exposure. All young in 30 and 40% WSF died within 7 to 8 days. For studies with A. valida, toxicity was high at 20% concentrations and all embryos were killed at 30% WSF. It is suggested from these results that crustacean eggs enclosed in hard cases or shells may be more resistant to toxic petroleum oils than eggs surrounded only by fertilization and jelly membranes. (Baker-FRC)
W81-00440

EFFECTS OF PRUDHOE BAY CRUDE OIL CONTAMINATION ON SEDIMENT WORKING RATES OF ABARENICOLA PACIFICA,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Research Lab.
J. M. Augenfeld.
Marine Environmental Research, Vol 3, No 4, p 307-313, September, 1980. 3 Tab, 1 Fig, 10 Ref.

Descriptors: *Sediment transport, *Oil pollution, *Feeding rates, *Indicators, *Worms, Turnovers, Sea water, Laboratory tests, Environmental effects, Organic compounds, Water pollution sources, Intertidal areas, Aquatic animals, Water pollution control.

The effect of sediment containing 250, 500, or 1,000 ppm Prudhoe Bay crude oil on the rate of feeding as measured by fecal production by lugworms (Abarenicola pacifica) was tested. Both lugworms and sediment were collected from the high intertidal region of an almost-enclosed lagoon adjacent to Sequim Bay, Washington. At oil concentrations of 500 and 1,000 ppm, the rate of feeding was reduced by 70%. Mean fecal production per unit body weight was moderately depressed in groups exposed to 250 ppm crude oil. Under normal conditions, smaller animals have higher rates of defecation than larger animals. The test results suggest that defecation rates may have potential application as an indicator of levels of environmental stress, and that under conditions of moderate pollution, lugworms may aid in recovery of intertidal zones by maintaining sediment transport through feeding activity. (Titus-FRC)
W81-00441

MICROBIOLOGY OF A PESTICIDE DISPOSAL PIT,
Iowa State Univ., Ames. Dept. of Bacteriology.
For primary bibliographic entry see Field 5E.
W81-00455

EVALUATION OF PENTRON D-90 TOXICITY TO JUVENILE ESTUARINE FISH AND BLUE CRABS,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
D. T. Buton.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 470-476, September, 1980. 4 Tab, 8 Ref.

Descriptors: *Crabs, *Fish, *Estuaries, *Sulfates, Toxicity, Powerplants, Industrial wastes, Iron, Aquatic animals, Bioassay, Water pollution, Effluents, Corrosion control, Aquatic envirnment.

Pentron D-90 is a low molecular weight polyacrylamide-based ferrous sulfate compound which is pending patent for use as a retardant of condenser tube corrosion in stream electric generating facilities. To provide baseline data on the possible toxicity of Pentron D-90 to estuarine organisms, 96-hr static bioassays were conducted on two species of crabs (Leiostomus xanthurus and Callinectes sapidus) and a juvenile Atlantic menhaden (Brevoortia tyrannus) from the Patuxent River, Maryland. A maximum Penton D-90 concentration of 5 mg/liter, similar to actual use levels, in filtered Patuxent River water was tested, since the entire compound and its derivatives will eventually be discharged into the aquatic environment. Result showed that Pentron D-90 was not toxic to juvenile Atlantic menhaden fish or crabs over a 96-hr period at the dose level tested. Calculation of total iron present in the test tanks throughout the 96-hr period indicated that no toxicity from ambient iron combined with iron released from Pentron D-90 would be expected to occur under the buffered conditions of normal estuaries. It was concluded that a Pentron D-90 discharge level of 5 mg/liter proposed for use in electrical plants would pose no harmful effects on estuarine crabs or fish. (Geiger-FRC)
W81-00456

ALGAE AS A CHEMICAL SPECIATION MONITOR-I A COMPARISON OF ALGAL GROWTH AND COMPUTER CALCULATED SPECIATION,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Chemistry.
R. D. Guy, and A. R. Kean.
Water Research, Vol 14, No 7, p 891-899, July, 1980. 6 Fig, 4 Tab, 43 Ref.

Descriptors: e, Phytotoxicity, Algal toxins, Monitoring, Speciation, Separation techniques, Growth rates, Aquatic environment, Laboratory tests, Computer models.

Heavy metals in the aquatic environment include metals in sediment, metals in suspended particulate or in solution, and metals absorbed onto hydrous oxide and humic colloids. Metals in true solution may be subdivided into free species, inorganic complexes, and complexes with naturally occurring ligands. Chemical speciation of metals is important in analytical and geochemical studies and especially in toxicity studies. Speciation may be studied by electrochemical methods, kinetic differences between complexes, or separation and determination of the metal content of each fraction. An alga, Selenastrum capricornutum, was used as a monitor to examine the relationship between toxicity and metal speciation. Two aspects of the effect of algae on copper speciation were studied in two separate experiments. In the first experiment, glycollic acid was used to complex the added copper, while in the second, the soluble copper/particulate ratio was found by centrifugation of algal suspensions containing different copper/ligand combinations. Increases in copper levels caused decreases in the algal growth rate as measured by chlorophyll fluorescence that were constant during a 24-hr experiment. Solutions containing ethylenediaminetetraacetate, triethylenetetraamine,

nitrilotriacetic acid, and bicine were toxic to algae at a pCu of 8.0. Solutions containing citric acid and ethylene-diamine became algicidal at pCu 9.5 and 8.65, respectively. A comparison of growth and computer-calculated speciation indicated that the copper ethylenediamine complex Cuen(2+) and the copper hydroxide-citric acid complex CuOH-cit(2-) were toxic species to algae. (Geiger-FRC)
W81-00494

5D. Waste Treatment Processes

THE COLLECTION, TREATMENT, AND DISPOSAL OF FARM WASTES,
Thames Water Authority, London (England). Conservancy Div.
R. P. Wheeler.
Effluent and Water Treatment Journal, Vol 20, No 8, p 386-390, August, 1980. 2 Fig, 2 Tab, 9 Ref.

Descriptors: *Farm wastes, *Domestic animals, *Organic wastes, *Oxidation, *Waste disposal, Sewage treatment, Slurries, Poultry, Methane, Cattle, Sewage lagoons, Farm lagoons, Odor, Recycling, Aeration, Spraying, Flocculation, Sludge disposal.

Several of the simpler methods of dealing with solid and liquid waste from cattle, pigs, and poultry are discussed. Labor difficulties and the problem of obtaining suitable litter for deep bedding have led to most farms converting to the slurry disposal system, which may be highly mechanized. Reception of waste is usually in a small tank for the initial separation of gross solids, followed by overflow to storage and/or treatment. Treatment is aimed at limiting odor nuisance during storage and disposal to the land and may take one of three forms: the oxidation-ditch system, usually with a paddle-wheel aerator, oxidation in tanks or lagoons with aeration via vanes or propellors, or the barrier-ditch system (for the brown water resulting from the final washing down of cowsheds, yards, and dairies). For pigs, attention is being focused on in-house treatment, usually by means of under-floor oxidation; a chemical flocculation process has reduced BOD from 40-200 to 10 mg/liter and suspended solids from 100-250 mg/liter to 0. The trend in the treatment of poultry waste is toward in-house drying. For the storage of slurry, either prefabricated cylindrical tanks or earth lagoons are used. Largely liquid effluent may be disposed to the land by spreading with tankers or tractor-drawn tanks with a spreading system designed to avoid formation of aerosol sprays and consequent odor. Techniques of subsoil injection are improving. Recycling manure as animal feed, silage, and methane production are also discussed. Complete treatment of farm wastes is rarely justified, as waste should be returned to the land wherever possible. (Gish-FRC)
W81-00251

HOGSMILL VALLEY SEWAGE TREATMENT WORKS,
Effluent and Water Treatment Journal, Vol 20, No 8, p 365, 368, August, 1980.

Descriptors: *Treatment facilities, *Activated sludge, *Sludge treatment, *Settling basins, *Aeration, Biological treatment, Dewatering, Drying, Sludge disposal, Land use, Waste disposal, Waste water treatment, Municipal wastes.

The Hogsmill sewage treatment plant serving the Borough of Kingsten, England is described. The plant operates on the diffused air activated sludge principle for biological oxidation. The facility has been the site of many studies including the air drying of sludge on beds and the effects of mixtures of activated and raw sludge on digesters. Sludge air drying beds were replaced by a system of thickening and transporting digested sludge to agricultural land. The Thames Conservancy had applied an effluent standard to the Hogsmill plant but this was abandoned to initiate improvements at the facility to meet existing standards. In the short time of this study, flow to the plant increased from 382 to 687 liters/sec without increases in plant capacity. High nitrification has occurred in the summer but the quality of final effluents have been generally maintained. Re-aeration channels have been remodeled for use as aeration channels. Changes in sludge withdrawal from final tanks have cut pump running expenses. Retention times for primary sedimentation tanks, aeration channels and final tanks are given. Costs of plant operation have risen dramatically in recent years. Automation is seen as the only solution in the near future to cover emergency and odd-shift labor demands of the Hogsmill facility. (Geiger-FRC)
W81-00252

ZERO DISCHARGE: IT WASN'T A COSTLY PIPEDREAM FOR ONE WATERWORKS,
American City and County, Vol 95, No 8, p 65-66, August, 1980. 3 Fig.

Descriptors: *Treatment facilities, *Coagulation, *Flocculation, *Filtration, *Zero discharge, Water treatment, Recycling, Sludge treatment, Drying, Settling basins, Costs, Installation costs, Operating costs, Seasonal, Water reuse, Municipal water, Dewatering, Chemical degradation, Potable water.

Zero discharge has been achieved at low cost by the Huntsville, Alabama water treatment plant after 18 months of operation. The plant's $4.3 million, 8.0 mgd expansion included a closed-loop filter backwash water recycling system, on-site drying beds for sludge dewatering, and on-site pit sludge disposal. Installation costs were $800,000, operation and maintenance costs were $3,000 for 1979, and sludge handling debt service was $60,000. Sludge disposal and dispersal cost $90/ton in 1979, much lower than for comparable plants. The treatment system at Huntsville includes rapid mixing, alum coagulation, flocculation/sedimentation, dual-media filtration, and chemical addition. The facility has a 2.0 million gallon underground reservoir. Filtration is high rate (60 gpm/sq ft, one filter; 4.0 gpm/sq ft, all filters). The plant is operating excellently with regard to turbidity and pH. The zero discharge system consists of liquid recycle back to the headworks and disposal of solids on site. Disposing of backwash water wastes about 2% of all treated water in a plant; thus this much is saved by recycling. Recycling backwash water also requires less horsepower to pump back through the plant than does raw water. Leopold units that float on the surface of the sedimentation basin remove sludge by siphoning. Their cost was about half that of a conventional sludge removal system. Ways of improving sludge handling in winter are being sought, as sludge production is 325 pounds/million gallons during this season compared with 100 pounds/million gallons in summer. (Gish-FRC)
W81-00257

OLD WATER SYSTEM GETS NEW LIFE,
E. Bilodeau.
American City and County, Vol 95, No 2, p 67-69, February, 1980. 3 Fig.

Descriptors: *Treatment facilities, *Flocculation, *Settling basins, *Filtration, *Lead, Waste water treatment, Costs, Control systems, Recycling, Leaching, Toxicity, Pollutants, Pipes, Chemical degradation, Municipal water, Water reuse, Potable water.

Prior to improvements made in the water system, the water in Bennington, Vermont, contained lead levels five times higher than what is considered safe, and 2,000 of the town's 10,000 residents succumbed to a waterborne disease. A 3 mgd water storage tank, a pumping station, and 20,000 feet of pipeline eliminated low water pressure. A prefabricated treatment plant with two modular filter units was put on line less than 11 months after construction began. This simple filtration system provides mechanical flocculation, tube settling, and mixed media filtration in the space normally occupied by clarifiers alone. Its construction and operating costs are low, and it is very reliable. The control system operates 24 hr/day with 8 hr of supervision, and is manually monitored, which gives the operator a positive control of the plant. The Bennington plant is capable of recycling all backwash water; this both conserves water and makes discharge permits unnecessary. It is also the first water treatment plant to incorporate a chemical process that successfully reduces lead contamination to levels acceptable under federal regulations. Food-grade sodium bicarbonate (550 pounds/day) with liquid sodium hydroxide (90 dry pounds/day) is added to the water. The latter raises the pH from a low of 4.7 to 8.5, while the former provides the alkalinity necessary (25 mg/liter) to form a hard, impervious lead coating on the inside of the lead service pipes which seals the pipe from water and eliminates leaching. Lead concentrations are now approximately 0.02 mg/liter compared with 0.25 mg/liter in May 1977. (Gish-FRC)
W81-00261

CHEMICAL AND MICROBIOLOGICAL IMPACT OF SEWAGE SLUDGE ON SOIL SYSTEMS,
Cook Coll., New Brunswick, NJ. Dept. of Soils Crops.
Lowell A. Douglas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121451, Price codes: A04 in paper copy, A01 in microfiche. New Jersey Water Resources Research Institute, Rutgers University, Final completin report, October 1980, 61 p, 25 Fig, 11 Tab, 41 Ref. OWRT-A-038-NJ(3), 14-31-0001-5030.

Descriptors: Water pollution control, *Sewage sludge, Ammonia, Nitrates, *Soil chemistry, *Soil amendments, Computer models, *Organic matter, Model studies, *Soil treatment.

The organic carbon decomposition and nitrogen transformations of two sewage sludges in a sandy loam soil were studied utilizing incubation experiments at temperatures from 8 to 22 deg. C. An 'active organic carbon' fraction decomposed at a higher rate than the bulk of the organic carbon. Q10 values for organic carbon were between 1.6 and 2 and varied with sludge type and sludge/soil ratios. The decomposition of the two sludges in soil was not significantly different at field capacity or at saturated moisture conditions. A regression model in the form of an exponential function between the CO2 evolution and the factors of time, temperature and rate of carbon added was developed, with a good fit to observed values. A simulation model for the transformation of nitrogen based on first and zero order kinetics was developed for the incubation study. A convenient computer program of the IBM 360/system, CSMP, was used to solve the differential equations in the model. The test of the model on the invubation experiment proved that the model was good and powerful in estimating the nitrogen status in such systems. (Douglas, Rutgers)
W81-00275

REMOVAL OF EUTROPHIC NUTRIENTS FROM WASTEWATER AND THEIR BIOCONVERSION TO BACTERIAL SINGLE CELL PROTEIN FOR ANIMAL FEED SUPPLEMENTS: PHASE I,
Catholic Univ. of America, Washington, DC. Dept. of Biology.
B.T. DeCicco.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124042, Price codes: A02 in paper copy, A01 in microfiche Water Resources Research Center, University of the District of Columbian, Washington, DC. Report 14, November 1977. 2 Fig, 4 Tab, 6 Ref. OWRT-A-006-DC(1).

Descriptors: *Waste water treatment, *Ammonia, *Phosphorus, Bacteris, Nitrates, Single cell protein, *Water reuse, Water pollution sources, Nutrients, Effluents, Sludge, Feeds, Biomass.

The hydrogen oxidizing chemolithotrophic bacterium Alcaligenes eutrophus has been emploed for the removal of eutrophic nitrogenous and phosphorus compounds from the final effluent and digester elutriate from the Blue Plains Wastewater Treatment Plant, Washington, D.C. Average removal levels from final effluent were 98% for ammonia, 67% for nitrate, 93& of TKN and 84% for total phosphorus. Mixtures of 1 part elutriate to

3 parts effluent yielded 88% removal of both ammonia and total phosphorus. No pretreatment of elutriate or effluent was necessary to support groth, and sterilization of wastewater samples yielded results similar to unsterile samples; i.e., the chemolithotroph need not be grown in pure culture. A hydrogen oxidizing chemolithotroph different from A. eutrophus has been isolated from Blue Plains final effluent and has been classified as a member of the genus Pseudomonas.
W81-00276

REMOVAL OF EUTROPHIC NUTRIENTS FROM WASTEWATER AND THEIR BIOCONVERSION TO BACTERIAL SINGLE CELL PROTEIN FOR ANIMAL FEED SUPPLEMENTS: PHASE II,
Catholic Univ. of America, Washington, DC. Dept. of Biology.
B. T. DeCicco.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124059, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center, University of the District of Columbia, Washington, D.C. Report 15, April 1979. 14 p, 4 Tab, 9 Ref. OWRT-A-006-DC(2).

Descriptors: *Wastewater treatment, *Ammonia, *Phosphorus, *Bacteria, Single cell protein, *Water reuse, Water pollution sources, Effluents, Nutrients, Microorganisms, Sludge, Feeds, Biomass.

The bacterium Alcaligenes eutrophus was grown in phosphorus supplemented digestor elutriate from the Blue Plains Wastewater Treatment Plant using a microbial fermentor. Gaseous hydrogen, oxygen and carbon dioxide were supplied as carbon and energy sources. Ammonia and phosphate removal averaged 87% and 93%, respectively, at the time of cell harvest. The cellular biomass was washed, dried, chemically analyzed and employed as the protein component of check diets. The biochemical composition of the wastewater grown biomass was 8.7% RNA, 1.3% DNA, 56% protein, 3.2% carbohydrate, and 30.8% lipid and inert materials. Chick feeding experiments demonstrated that the bacterial biomass had a protein quality of 88% compared to reference casein. In sterilized samples of sludge: effluent at dilutions of 1:4, 1:8 and 1:20 under a H2, O2CO2 atmosphere, growth of A. eutrophus was substantial and was proportional to the sludge concentration, reaching 8 x 10 to the ninth power organisms/ml in the 1:4 mixture. When the gas atmosphere was replaced by air, growth was substantially less. Chemical analyses of the treated mixtures showed 89-92% ammonia removal and 98-99% phosphate removal from gassed cultures. Cultures incubated under air showed increases in ammonia levels of 25-67% and phosphate reductions of approximately 90%. The bacterial system employed in these studies appears to be an efficient means of removing nitrogenous and phosphorus pollutants from final effluent, digester elutriate and undigested sludge resulting from wastewater treatment. The bacterial biomass produced during elutriate treatment appears to possess high nutritive value as a protein source for chick feed.
W81-00277

REMOVAL OF EUTROPHIC NUTRIENTS FROM WASTEWATER AND THEIR BIOCONVERSION TO BACTERIAL SINGLE CELL PROTEIN FOR ANIMAL FEED SUPPLEMENTS: PHASE III,
Catholic Univ. of America, Washington, DC. Dept. of Biology.
B. T. DeCicco.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124067, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center, University of the District of Columbia, Washington, D.C. Report 16, April 1980. 13 p, 2 Fig, 3 Tab, 9 Ref. OWRT-A-006-DC(3).

Descriptors: *Wastewater treatment, *Ammonia, *Phosphorus, *Bacteria, Single cell protein, Water reuse, Water pollution sources, Nutrients, Effluents, Sludge, Feeds, Biomass.

We previously have demonstrated that the bacterium Alcaligenes eutrophus is an efficient and effective remover of nitrogenous and phosphorus compounds from municipal wastewaters. Further, the biomass generated from growth on wastewater proved to be a source of high quality protein for the growth of chickens. During this phase a quantity of biomass grown in the fermentor on digester elutriate was treated with a variety of conditions in order to find conditions which promoted cellular aggregation, since this would allow easier separation of cellular biomass from the treated wastewaters. Two treatments produced sedimentation of the cells: either addition of alkali to pH 11 or the addition of an anionic exchange resin (Cellex-D) produced aggregation of the biomass and clarification of the wastewaters. Elutriate samples that were unheated and then inoculated with A. eutrophus yielded little growth, while samples heated to 50 and 70 deg. C produced cell densities that were 74% and 94% respectively, as high as a sample sterilized by autoclaving. Thus a heat labile inhibitor of A. eutrophus was present in elutriate. Samples of digester elutriate, secondary digested sludge and primary undigested sludge were analyzed for the presence of mutagenic substances using the Ames Salmonella mutagenicity test. Samples were assayed both with and without metabolic activation with rat liver S-9 mix. Tests were negative with all samples and bacterial strains with the possible exception of a marginally positive response with both sludge and elutriate samples tested with strain TA 1537.
W81-00278

GAS TREATMENT OF LIQUID,
Stamicarbon, BV., Geleen (Netherlands). (Assignee).
F. J. Fontein, and H. F. Jennekens.
U.S. Patent No. 4,189,384, 6 p, 3 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 990, February 19, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Aeration, Biological treatment, Jets, Equipment.

The purpose of the invention is to achieve improved aeration of waste water in biological purification installations, to keep the water in the basin in motion, and not to damage substances that are present in the liquid. Gas is supplied under pressure to a generally bell-shaped chamber placed below the surface of a body of wastewater to form a gas space in the chamber. A stream of liquid is introduced into the gas space in the form of at least one liquid jet which passes through the gas space and into the liquid to drive gas into the liquid. The chamber is effectively placed one to several meters below the water surface. The water jets may be formed with the aid of a horizontal feed tube provided with one or more outlet apertures which face downwards at a slant. (Sinha-OEIS)
W81-00372

WASTE WATER TREATMENT,
Amax, Inc., Greenwich, CT. (Assignee).
J. M. Laferty, G. G. Van Riper, and W. P. Zundel.
U.S. Patent No 4,189,381, 6 p, 1 Fig, 4 Tab, 5 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 989, February 19, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial waters, Molybdenum, Heavy metals, Separation techniques, Ion exchange, Chemical precipitation, Flocculation, Electrolysis, Foam separation, Cyanides.

The invention relates to the treatment of industrial waste water for recycling to surface waters and to the treatment of waste water obtained in mineral recovery processes, such as in the flotation recovery of molybdenite. Waste water containing over 2 ppm Mo and at least one heavy metal impurity selected from the group consisting of Fe, Mn, Cu, Zn, Pb, and Cd, and also containing cyanide ion (CN) is treated by passing waste water having an adjusted pH value ranging from about 3 to 4 through an ion-exchange resin column selective to the removal of Mo and provide an ion-exchange effluent containing at least one of the heavy metal impurities and the cyanide ion. The pH value of the effluent is then adjusted to a range of about 7 to 11 sufficient to precipitate the heavy metal impurity having the highest pH requirement for precipitation. The precipitate is flocculated and the effluent containing the flocculated precipitate is subjected to electrolysis using insoluble electrodes to form electroflotation of the flocculated precipitate to form a froth which is separated from the effluent by skimming. (Sinha-OEIS)
W81-00374

BIOLOGICAL TREATMENT AND TOXICITY STUDIES,
Beak (T. W.) Consultants Ltd., Vancouver (British Columbia).
Environmental Protection Service, Ottawa, Ontario, Canada, Water Pollution Control Directorate. Economic and Technical Review Report EPS 3-WP-73-6, 1973. 64 p, 51 Fig, 14 Tab, 27 Ref, 7 Append.

Descriptors: *Alberta, *British Columbia, *Aerated lagoons, *Biological treatment, Kraft mills, Mathematical modelling, Effluents, Testing, Evaluations, Heat loss, Data collection, *Waste water treatment, Lagoons, Canada.

The results of a comprehensive survey of three aerated lagoons treating kraft mill effluents in Western Canada are presented. Each lagoon is provided with surface mechanical aeration and has a residence time of five days. Long term operating data for each system is reported including summer and winter BOD removal efficiencis, aerator loadings, and oxygen transfer efficiencies. Consieration was given to start-up procedures, temperature losses through the lagoon, optimum nutrient additions, pH effects, quiescent zones, and sludge accumulations. A detailed investigation of the overall mixing conditions in an aerated lagoon was made using Fluorescent tracer techniques. Lagoon geometry was more important than aeration horsepower in determining the mixing characteristics. Mathematical mixing models were developed for each system and are useful both for aerated lagoon performance prediction and for aerated lagoon design. (WATDOC)
W81-00389

ON-SITE TREATMENT FOR LOW-DENSITY AREAS,
American City and County, Vol 95, No 4, p 45-48, April, 1980. 2 Fig, 1 Tab.

Descriptors: *Domestic wastes, *Waste treatment, *Sewerage, Septic tanks, Sewage disposal, Waste disposal, Costs, Sand mounds, Leaching, Absorption, Anaerobic digestion, Sewage lagoons, Filters, Evapotranspiration.

Various means for achieving on-site treatment of household wastes are explained. EPA figures indicated that, in 1978, 32% of the population in the U.S. was not served by primary, secondary, or advanced waste treatment facilities. The septic tank/leaching field is suitable where soils have a percolation rate no faster than 0.1 min/inch and no slower than 60 min/inch. High seasonal water table areas must be avoided. Elevated sand mounds may be used in soils that cannot support an absorption field. Mounds must be shaped and located to function according to effluent flows and topography. They must not be located on slopes of > 12%. For a standard three-bedroom home with an estimated flow of 450 gpd, a mound with a base area of 7,200 sq ft is needed. Aerobic and anaerobic lagoons may also be used to catch septic tank effluent. In some places, such lagoons have met the 30/30 BOD suspended solid standard most of the year. Evapotranspiration beds have worked well in cold weather regions. However, in other areas, continual surface overflowing has caused problems. Sand filters can cost $3,000-$4,000 and are of two types, intermittent and recirculating. Non-soil-dependent on-site systems usually consist of small, aerobic package units and one of the treatment/disposal options associated with septic tanks. (Baker-FRC)
W81-00419

EBMUD: AWARD WINNING SEWAGE WORKS,
American City and County, Vol 95, No 6, p 47-49, June, 1980. 6 Fig.

Descriptors: *Activated sludge, *Chlorination, *Sewage treatment, *Water reuse, *Oxygen activated sludge, Anaerobic digestion, Pumps, Pacific Coast Region, Recycling, Treatment facilities, Industrial water, Industrial wastes, Domestic water, Oxygen, Disinfection, Water purification, Reclamation, Waste water treatment, Nitrification.

The first large-scale pure oxygen activated sludge secondary treatment system in California is discussed. This facility, located in the East Bay Municipal Utility District in Oakland, meets federal and state requirements for discharges to San Francisco Bay and also reclaims up to 1.0 mgd of treated effluent for in-plant use. Both domestic and industrial waste water are treated for an area of 83 sq miles and for 600,000 people. Primary treatment, effluent disinfection, and water reclamation for in-plant use are discussed. A UNOX high-purity oxygen activated sludge system provides secondary treatment for the plant's 71 mgd of waste water. This process has a peak hydraulic capacity of 168 mgd. A three-stage open-top nitrification tank with fine bubble diffusion of high-purity oxygen is used to polish secondary effluent to produce the industrial grade water. (McKeon-FRC)
W81-00421

LEACHATE CONTROL DOESN'T COME EASY,
American City and County, Vol 95, No 5, p 69-72, May, 1980. 3 Fig, 1 Tab.

Descriptors: *Leachate, *Landfills, *Water pollution control, *Waste disposal, Waste water, Sewage treatment, Drainage systems, Waste treatment, Runoff, Groundwater, Percolation, Recycling, Legislation, Sewerage, Waste water treatment.

Sanitary landfills almost always produce leachate, and BOD, COD, suspended solids, and turbidity are much greater in leachate than in raw municipal waste water. In addition, the former often also has low pH, low dissolved oxygen, toxic chemicals, and heavy metal ions. Leachate treatment systems range from those based entirely on soil attenuation to a complex chain of physical-chemical and biological steps. Collection systems generally depend either on a relatively impermeable natural clay liner or on an artificial membrane at the bottom of the fill. Runoff should be diverted into drainage channels, and slopes of 3-5% are recommended. The Henrico County, Virginia landfill has no artificial liners, collection mechanisms, or treatment systems; ground- and surface water is diverted round the site, all leachate will move to a treatment zone before discharge, there will be four or six leachate flow-through impoundments, and the site accepts no industrial or hazardous wastes or sewage sludge. In Montgomery County, Pennsylvania, leachate recycling has been practiced for the last 5 yr with moderately good results. In Wisconsin, some fills discharge leachate directly into sewage systems with no ill effects, and fills have been placed below the zone of saturation without groundwater contamination (clayey soils are particularly suitable); also, a law requiring treatment of leachate 20-30 yr after site closure is in effect. Percolation must be reduced, and a means of forecasting the amount and type of leachate that will be produced in the long term must be devised. (Gish-FRC)
W81-00423

REMOVAL OF NITROGEN FROM INDUSTRIAL WASTE WATERS BY BIOLOGICAL NITRIFICATION-DENITRIFICATION,
Degremont S.A., Rueil-Malmaison (France).
M. A. Picard, and G. M. Faup.
Water Pollution Control, Vol 79, No 2, p 213-224, 1980. 5 Fig, 4 Tab, 10 Ref.

Descriptors: *Nitrification, *Denitrification, *Biological treatment, *Industrial wastes, Sludge treatment, Nitrogen-fixing bacteria, Waste water treatment, Water pollution sources, Fertilizers, Explosives, Chemical wastes, Nutrients, Carbon, Equipment.

The level of nitrogen in industrial waste waters depends upon the type of industry which produces the pollution. Considerable variations in the nitrogen levels of effluents from different industries are found, with highest concentrations being produced during the manufacture of nitrogen-based fertilizers, gunpowder and explosives, and chemicals. More than 90% of the nitrogen contamination may be removed from industrial effluents by nitrification-denitrification techniques. Precautions must be taken to ensure that the influent contains no products that are harmful to the nitrification process. At the Hoechst Cuise Lamotte plant in France, nitrification was halted for three weeks when a product toxic to nitrifying bacteria was discharged. An external source of carbon may be needed to allow denitrification to proceed depending upon the effluent composition. Single-, two-, or even three-sludge systems may be used depending on whether treatment of carbonaceous pollution, nitrification, and denitrification are to be kept as separate processes or combined. In a single-sludge system, the anoxic tank will remain at the inlet, while in the two-sludge system based on nitrification in the first tank, denitrification will be carried out in a separate tank, yielding savings in the size of tanks required. However in the two-sludge system, the problems connected with precise dosing of organic carbon pose a severe limitation. Good results are obtained with the single-sludge process without the need of a sophisticated method of organic carbon addition. (Geiger-FRC)
W81-00425

THE EFFECTS OF NITRATE CONCENTRATION AND RETENTION PERIOD ON BIOLOGICAL DENITRIFICATION IN THE ROTATING-DISC SYSTEM,
Stuttgart Univ., (Germany, F.R.).
P.-S. Cheung, and K. Krauth.
Water Pollution Control, Vol 79, No 1, p 99-105, 1980. 6 Fig, 2 Tab, 8 Ref.

Descriptors: *Nitrification, *Denitrification, *Waste water treatment, Biological treatment, Sewage treatment, Sludge treatment, Sewage bacteria, Nitrates, Rotating disc system, Anaerobic conditions, Alcohols, Effluents.

Rotating disc systems (RDS) have been used successfully to remove oxidized nitrogen compounds from waste water by biological denitrification. This requires a carbon source, appropriate bacterial populations, and anaerobic conditions. The influence of retention period and nitrate levels on the denitrification process in an RDS were studied at 20-22 C and pH 7-8. The RDS used was 1.0 m in diameter and had an area of 14.97 sq m. The rotation speed was 3.23 rpm for each phase of a two-part experiment. During the first phase, the retention periods and nitrate loadings were varied, while in the second phase, retention periods were varied and nitrate loadings were kept constant. Nitrate nitrogen, nitrite nitrogen, ammoniacal nitrogen and residual methyl alcohol were determined in filtered samples daily. BOD and sludge production were analyzed at the end of each experiment. Results showed that the denitrification rate and sludge production are linear functions of nitrate loading. Within a nitrate loading range up to 18.85 g/sq m/day, a first order reaction took place for denitrification in the RDS with respect to nitrate levels in the influent. An optimum hydraulic retention period of 1.5 hr was recommended. The solids retention period was also found to be a linear function of nitrate loading as well as of the hydraulic retention period. Suspended solids in the effluent (wasted sludge) could not be regulated in the RDS; therefore a system with a larger disc is recommended to provide a higher solids retention period to yield greater stability and flexibility during the denitrification process. (Geiger-FRC)
W81-00428

EFFECT OF SYSTEMS SOLIDS RETENTION TIME (SSRT OR SLUDGE AGE) ON NITROGEN REMOVAL FROM ACTIVATED-SLUDGE SYSTEMS,
Toronto Univ. (Ontario).
P. H. Jones, and H. M. Sabra.
Water Pollution Control, Vol 79, No 1, p 106-116, 1980. 13 Fig, 8 Tab 28 Ref.

Descriptors: *Waste water treatment, *Denitrification, *Nitrification, *Sludge treatment, Biological treatment, Nitrates, Heavy metals, Toxins, Sludge age, Suspended solids, Dissolved oxygen, Nitrogen, Domestic wastes, Oxidation, Alkalinity.

Many biological processes have been developed for the reduction of nitrogen in waste water treatment. One theory proposed that the solids retention time (SRT) governed the kinetics of the biological treatment processes. The quality of the effluent, volatile suspended solids, and oxygen demands were shown to be a function of sludge age. Nitrification requires dissolved oxygen (DO) to complete the oxidation of nitrogen, while denitrification calls for a suitable environment for the reduction of nitrate to nitrogen gas. Other factors affecting nitrification are pH, alkalinity, DO levels and the presence of heavy metals or toxic substances. The effect of systems SRT (SSRT or sludge age) on total nitrogen removal was evaluated at 7, 15, and 25C. Results showed that at a constant temperature, increasing the SSRT increases the total nitrogen removed from the system. Almost complete nitrogen removal occurred with SSRT values of 3 days at 25C, 6 days at 15C, and 20 days at 7C. The rate of ammoniacal nitrogen oxidation increased with increasing sludge age. Results of the present study agreed well with the Marais equation for predicting minimum sludge age required to achieve complete nitrification at different temperatures. The assumption of zero-order reaction for both nitrification and denitrification rates proved valid for the levels of nitrogen commonly present in domestic waste water. (Geiger-FRC)
W81-00429

POSSIBLE EFFECTS OF PHOSPHORUS ON ALGAL GROWTH IN BARTON BROAD AND RELATED CONTROL MEASURES,
Anglian Water Authority (England). Norfolk and Suffolk River Div
For primary bibliographic entry see Field 5C.
W81-00430

MICROSCSREENS POLISH LAGOON EFFLUENT,
M. E. Harrelson.
American City and County, Vol 95, No 5, p 75-77, May, 1980. 2 Fig.

Descriptors: *Sewage lagoons, *Chlorination, *Screens, *Waste water treatment, Biological oxygen demand, Suspended solids, Algal control, South Carolina, Ponds, Control systems, Oxidation lagoons, Effluents, Sewage treatment, Costs, Construction costs, Municipal wastes.

zn overloaded lagoon in Camden, South Carolina was upgraded by the installation of ultrafine screens. Tests showed that microscreens with one micrometer polyester media could effectively screen out algal solids from oxidation pond effluents without the use of chemicals and at the same time maintain secondary treatment standards in the effluent. During a 24-hr pilot test, the microscreen reduced the average influent suspended solids from 128 ppm to 19 ppm and average BOD from 37 ppm to 16 ppm. Average flow rate through the screen was 2.0 gpm/sq ft of new effective submerged area. The new facility includes a mechanically cleaned bar screen followed by two 15-acre oxidation ponds. The first pond has three plug-flow aeration cells created with floating aerators and curtain partitions. Pond effluent is lifted to the microscreens by variable speed screw pumps. Six 10 ft x 16 ft microscreens remove the algae. Screen effluent is then chlorinated and discharged. Piping and valving will allow parallel, series, or single cell operation of the lagoons. This facility will be the first completely automatic microscreen operation using on-line suspended solids monitoring and process control. The construction

contract costs for this facility was $2.3 million, or $1.22/gal of plant capacity compared with $2.14/gal of plant capacity for a conventional activated sludge facility. (McKeon-FRC)
W81-00432

PLANNED PROCESSING BEATS BACK WATER-PLANT SLUDGE DISPOSAL PROBLEMS,
Pirnie (Malcolm), Inc., Paramus, NJ.
For primary bibliographic entry see Field 5F.
W81-00438

BACTERIAL DIE-OFF AND STREAM TRANSPORT STUDIES,
Canada Centre for Inland Waters, Burlington (Ontario).
B. J. Dutka, and K. K. Kwan.
Water Research, Vol 14, No 7, p 909-915, July, 1980. 5 Fig, 5 Tab, 11 Ref.

Descriptors: *Disinfection, *Chlorination, *Pathogenic bacteria, *Waste water treatment, Aquatic bacteria, E. coli, Salmonella, Streptococcus, Streams, Lake Ontario, Mutagens, Carcinogens, Tracers, Mortality, Public health, Water pollution sources, Sewage effluents.

The effects of chlorination and other disinfection processes on aquatic life exposed to low residual levels have become important with regard to possible mutagenicity and carcinogenicity of these compounds. Two experiments using bacteria as indicator organisms to monitor levels of residual disinfectants from waste water treatment processes are reported. An investigation was made of the rate of transport and survival period of Serratia marcescens in a small Canadian stream, while a second study examined the die-off rate of E. coli, Streptococcus faecalis, and Salmonella thompson in membrane filter chambers in Lake Ontario and Hamilton Bay. Results showed recovery of S. marcescens up to 22 days. This bacterium was also traced for a distance of 20 km. Survival studies of indicator organisms and pathogens in Hamilton Bay and Lake Ontario resulted in a minimum survival for all three organisms of 28 days. E. coli displayed a much slower die-off rate than S. faecalis, suggesting that infrequent point discharges of fecal matter had a possible cumulative effect which would promote the growth of pathogens and pose a threat to health. Complete removal of viable microorganisms by sewage treatment processes may be necessary before any consideration is given to the elimination of disinfection procedures. (Geiger-FRC)
W81-00492

REMOVAL OF ORGANICS IN WATER USING HYDROGEN PEROXIDE IN PRESENCE OF ULTRAVIOLET LIGHT,
Health and Welfare Canada, Ottawa (Ontario). Monitoring and Criteria Div.
For primary bibliographic entry see Field 5F.
W81-00498

DETERMINATION OF BIOLOGICAL REMOVAL OF ORGANIC CONSTITUENTS IN QUENCH WATERS FROM HIGH-BTU COAL-GASIFICATION PILOT PLANTS,
Argonne National Lab., IL. Energy and Environmental System Div.
V. C. Stamoudis, and R. G. Luthy.
Water Research, Vol 14, No 8, p 1143-1156, August, 1980. 5 Fig, 6 Tab, 10 Ref.

Descriptors: *Organic wastes, *Coal mine wastes, *Activated sludge, Industrial wastes, Gas chromatography, Waste treatment, Mass spectrometry, Biological treatment, Aromatic compounds, Pilot plants, Organic compounds, Quenching, Phenols.

The efficiency of a bench scale, activated-sludge treatment to remove organic constituents from coal-gasification process effluents was examined. Raw gas quench waters were obtained from two gas technology pilot plants to evaluate the efficiency of biological oxidation for organic removal. Bituminous Illinois No. 6 coal was used for the HYGAS steam-oxygen process and Indian Head lignite was used for the slagging, fixed-bed (SFB) process. The biological reactors employed were complete-mix, single-stage, air-activated sludge reactors with internal clarifiers. Influent and effluent reactor samples were extracted with a methylene chloride pH-fractionation technique into acid, base, and neutral fractions. Each fraction was subjected to capillary-column gas chromatography/mass spectrometry. Almost 99% of extractable and chromatographic organic material of both HYGAS and SFB influent acid fractions consisted of phenols and alkylated phenols. These compounds were removed almost completely by activated sludge treatment. Satisfactory removal was achieved for base-reaction organics with the exception of certain alkylated pyridines. Removal of neutral-fraction organics was also good, except for certain alkylated benzenes, certain polycyclic aromatic hydrocarbons, and some cycloalkanes and cycloalkenes, especially when influent levels were low. (Geiger-FRC)
W81-00500

5E. Ultimate Disposal Of Wastes

MAKE SEWAGE A VALUABLE COMMODITY,
Westminster, CO.
For primary bibliographic entry see Field 3D.
W81-00258

SLUDGE TREATMENT VS. ENERGY CONSERVATION,
K. Grover.
American City and County, Vol 95, No 2, p 39-40, 42, February, 1980. 2 Fig.

Descriptors: *Sludge treatment, *Energy, *Heat treatment, Chemical degradation, Costs, Sewage sludge, Sewage treatment, Dewatering, Ultimate disposal, Waste water treatment, Sludge digestion, Solid wastes, Water pollution control, Treatment facilities.

Problems are experienced by communities with an abundance of 'untreatable' sludge. Sludge comprises about 50% of the total treatment cost and 90% of the problems associated with waste water treatment. Each year about 4.2 million tons of sludge are produced. This will increase to 6.7 million tons by 1985. Digestion, which was the most common treatment method, does not meet new federal standards. For sludge that would dewater easily, heat treatment was used until its cost escalated after 1972. In 1972, costs for heat and chemical treatment were about the same. In 1979, the heat treatment of sludge cost $42/ton more than chemical treatment. Odor control and the disposition of the cooking liquor are also problematic. However, wet air oxidation, a heat treatment system, is working impressively, and new ideas about the placement of the heat treatment equipment in the overall design of the system may improve efficiency. The heat treatment reactor temperature ranges from 300 to 500 F, killing viruses and rendering the sludge sterile. Heat treatment can produce a dewatered sludge cake of 30-40% solids by weight. Chemical conditioning produces a cake of 15-20% solids at a smaller loading rate on dewatering equipment. However, heat treatment can deliver smaller solids loads downstream. (Baker-FRC)
W81-00439

SEWAGE-SLUDGE INCINERATION RAISES AIR POLLUTION CONCERNS,
Environmental Protection Agency, New York.
R. T. Dewling.
Water and Sewage Works, Vol 127, No 10, p 26-29, 43, October, 1980. 4 Fig, 5 Tab, 10 Ref.

Descriptors: *Incineration, *Sludge disposal, *Air pollution, Sewage sludge, Sewage treatment, Water pollution, Heavy metals, Organic compounds, Polychlorinated biphenyls, Temperature, Particle size, Toxins, Lead, Cadmium, Ultimate disposal, Trace elements.

Compliance of sewage sludge incinerators with federal standards for emissions and opacity depends on the characteristics of the feed sludge and operating temperatures. Multiple-hearth and fluidized bed incinerators are used in the U.S. The environmental impacts of incineration include water pollution due to boiler blowdown and scrubber water discharges as well as ash handling and disposal. Most of the heavy metals found in sludge are concentrated in the ash at levels of $> 1\%$. Poor incineration can lead to the formation of odorous, partially oxidized hydrocarbons (e.g., aldehydes, ketones) and sometimes sulfur oxides. Uncontrolled particulate emissions may vary from 4-110 kg/mg dry sludge input, depending on incinerator type and sludge composition (e.g., percentage volatile solids, moisture). Organic pollutants, including polychlorinated biphenyls, low-molecular weight hydrocarbons, and heavy metals, may be emitted if operating conditions are inadequate. EPA tests of a fluidized-bed incinerator in the New York metropolitan area indicated that, when incinerator temperatures increased from 1,200 to 1,750 F, lead emission increased 25-fold (3.1-77.0 mg/g) and cadmium increased almost 10-fold (1.0-8.1 mg/g). These increased emissions are associated with respirable particles of < 3 micrometers. The lowest possible trace metal emission would be provided by a two-stage system where the main incinerator is operated at the lowest possible temperature while an afterburner operates at a very high temperature ($=$ or $>$ 1,800 F). This would be followed by air-pollution control, so most of the toxic organics would be destroyed. (Gish-FRC)
W81-00442

INCINERATION IS A WASTE-MANAGEMENT ALTERNATIVE,
W. R. Niessen.
Water and Sewage Works, Vol 127, No 10, p 30-31, 49, October, 1980. 2 Fig, 2 Ref.

Descriptors: *Incineration, *Heat balance, *Waste disposal, *Temperature, *Solid wastes, Toxicity, Water pollution, Air pollution, Energy, Conservation, Costs, Heavy metals, Inorganic compounds, Gases, Sewage sludge, Dusts, Waste water(Pollution), Ultimate disposal.

Incineration as an alternative to hazardous waste management is being encouraged, even though there are operating and environmental problems associated with this method. The advantages of incineration include volume reduction, regulatory compliance, detoxification, and energy recovery, while the disadvantages are cost, operational and staffing problems, air and water pollution, public-sector reaction, and technical risk. Analysis of energy effects for most combustion systems emphasizes the benefits of concentrating combustibles. Waste combustion can produce air pollutants, but in amounts that can be anticipated. The appearance of combustible particulate in incinerator effluent reflects inadequate combustion effectiveness. Mineral particulates from incinerator stacks can become contaminated by enriched concentrations of heavy metals. The degree of concentration in the particulate relative to the bulk waste depends on the physical form of the waste and on the nature of the heavy metals. Gaseous pollutants include sulfur oxides, hydrogen chloride, and nitrogen oxides. The most important parameter for a combustor is volumetric heat release rate, and the second is peak combustion temperature. Three major residue streams are produced by an incinerator: that from the primary chamber, dusts in flues, and scrubber sludge. A waste water stream may also be produced. (Gish-FRC)
W81-00443

MICROBIOLOGY OF A PESTICIDE DISPOSAL PIT,
Iowa State Univ., Ames. Dept. of Bacteriology.
L. M. Johnson, and P. A. Hartman.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 448-455, September, 1980. 1 Fig, 2 Tab, 16 Ref.

Descriptors: *Pesticides, *Microbiology, *Bacteria, *Waste disposal, Pseudomonas, Cultures, gas chromatography, Liquid wastes, Soil microbiology, Rocks, Chlorinated hydrocarbon pesticides, Carbamate pesticides, Organophosphorus pesti-

cides, Triazine pesticides, Ultimate disposal, Underground waste disposal.

The microbiological activity of the pesticide disposal pit at Iowa State University was monitored after 8 yr of use. Pesticides disposed of in the pit included chlorinated hydrocarbons, triazines, organophosphates, and carbamates. The pit was 0.9 m deep at one end and 1.2 m deep at the other with dimensions of 9.1 m by 3.7 m. Sample pipes were placed 2 m apart along the central axis of the pit, and aqueous samples drawn from them were processed aerobically and anaerobically to evaluate microbial life. Pit soil samples were collected near each sample pipe. Submerged rocks were randomly collected from the pit and scrubbed in sterile deionized water. Rock washings were diluted and plated on peptone agar to determine viable cell numbers. Eighty-nine percent of the 119 randomly selected isolates from pit liquid were gram-negative rods. Of these, 65% were pseudomonads. Twenty-nine percent of the pit liquid isolates were unidentifiable motile, gram negative rods, while gram positive bacteris were mostly Arthrobacter (7%), Micrococcus (3%), and Streptomyces (2%). Six of 20 isolates selected on the basis of colonial morphology grew well in sterile pesticide pit liquid. Viable cells per gram of soil ranged from 400,000-630,000 on trypticase soy agar. Bacteria found in soil included the Bacillus species (50%), Pseudomonas (21%), gram-negatie rods (21%), Citrobacter (4%), and Arthrobacter (1%). Bacterial species found on rock surfaces resembled those recovered from pit soil. No pesticide-free control pit was available for comparison. Day to day fluctuations were noted in pit temperature and pH The presence of a particular bacteria in the pit did not prove that pesticies were degraded by that organism. Gas chromatographic studies on pit liquid showed no long-term accumulation of any pesticide. (Geiger-FRC)
W81-00455

5F. Water Treatment and Quality Alteration

THE MECHANISM OF OZONE INACTIVATION OF WATERBORNE VIRUSES,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
O. J. Sproul, and C. K. Kim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127334, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, July, 1980. 32 p, 8 Fig, 3 Tab, 38 Ref. OWRT-B-013-ME(2).

Descriptors: *Ozone, *Waste water treatment, *Water treatment, *Chlorination, *Disinfection, *Viruses, *Bacteriophage, Oxidation, Water quality, Water quality control, Odor, Treatment, Water purification, Chemical reactions, Aquatic microbiology, Diseases, Biocontrol, Infection, Microorganisms, Water pollution, Water pollution sources.

Ozone has received recent attention as an alternative disinfectant to chlorine in water and waste water treatment practices due to its more rapid powerful germicidal activity and no reported side-effects as can result from chlorination, such as taste, odor, and toxic byproducts. The present study sought to determine the ozone inactivation mechanism for viruses in water using the f2 RNA containing virus and T4 DNA containing virus bacteriophages as models. It was concluded that ozone inactivated the f2 and T4 bacteriophages by attacking capsid protein, with liberation and inactivation of the nucleic acid. RNA from f2 bacteriophage at least partially inactivated prior to release from the capsid, with the inactivation rate slower than the whole phage but faster than the naked RNA exposed to ozone. Finally, DNA released from T4 bacteriophage was rapidly inactivated by ozone at about the same rate as the intact phage. The study results suggested that the RNA of enteric viruses may retain their infectivity after liberation from the viral particle during ozonation of water and waste water, if they are inactivated by ozone in the same manner as the f2 phage. (Zielinski-IPA)
W81-00315

APPARATUS FOR CONTROLLED CHLORINATION OF WATER WITH AN ALKALI METAL DICHLOROISOCYANURATE,
FMC Corp., Philadelphia, PA. (Assignee)
C. D. Watson.
U.S. Patent No 4,181,702, 13 p, 3 Fig, 26 Ref; Official Gazette of the United States Patent Office, Vol 990, No 1, p 275, January 1980.

Descriptors: *Patents, *Water treatment, *Water purification, *Chlorination, Quality control, Disinfection, Instrumentation, Equipment.

An apparatus and method are disclosed for the controlled chlorination of a water supply in which an alkali metal salt of dichloroisocyanuric acid is dissolved to form a concentrated chlorine solution that is slowly released into the water supply. The apparatus contains an internal standpipe, open to the water supply at its bottom end and having water inlet apertures and solution metering apertures in its wall. The natural circulation of water in the sandpipe through the solid dichloroiscyanurate charge contained in the apparatus in chlorination of the water supply at a rate controlled by the size number of solution metering apertures. (Sinha-OEIS)
W81-00376

MINE DEWATERING,
For primary bibliographic entry see Field 6E.
W81-00398

THE IMPACT OF DESALTING ON WATER SUPPLY - ALAMOGORDO, NEW MEXICO,
Herkenhoff (Gordon) and Associates, Albuquerque, NM.
D. D. Jardin.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 192-195. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *New Mexico, *Desalination, *Water supply, *Water quality, *Construction costs, *Saline water, Planning, Legislation, Engineering, Descaling, Dissolved solids, Research and development.

Alamogordo was one of two cities selected by OWRT to have a demonstration program of desalting technology. Their water quality is good; however, the supply meeting federal standards does not meet demand, especially in midsummer The only additional supply is groundwater. The OWRT has agreed to pay 85% of the construction costs ($13 million) for a plant capable of treating two million gallons a day. Final water approval to proceed is pending. Higher quality water improves the taste of food, reduces soap use and extends the lives of appliances. The average homeowner would save approximately $9.56 a month, or $114 a year, as a result of reduced appliance maintenance, soap use, and municipal costs. Alamogordo has the opportunity to lead the state in desalting technology, to produce high quality water and to help other communities learn how to improve their water supply. (Atkins-Omniplan)
W81-00400

DISPUTES OVER WATER QUALITY POLICY: PROFESSIONAL CULTURES IN CONFLICT, 1900-1917,
Carnegie-Mellon Univ., Pittsburgh, PA.
J. A. Tarr, T. Yosie, and J. McCurley, III.
American Journal of Public Health, Vol 70, No 4, p 427-435, April, 1980. 1 Fig, 51 Ref.

Descriptors: *Sewerage, *Public health, *Sanitary engineering, *History, Political aspects, Combined sewers, Riparian rights, Municipal water, Filtration, Economic feasibility, Water quality standards, Legislation.

A review of historical information concerning disputes between professional groups over water quality policy between 1900 and 1917 indicates that the issues have remained the same through history. The origin of the dispute concerned the health-efficacy of combined or separate sewers. The central issue was which profession was most qualified to determine public health standards and policy within the framework of municipal cost constraints. Construction of sewage systems causing deterioration of downstream water supplies resulted in a wave of legislation and numerous court cases identifying responsibilities of riparian users. Water quality enforcement was primarily entrusted to health professionals, yet included sanitary engineers. The year 1900 marked the beginning of debate between engineers and physicians over water filtration versus sewage treatment plus water filtration as means of protecting water quality and reducing typhoid fever hazard. Economic feasibility and professional expertise were the focus of the debate. A case study of the history of sewage treatment in Pittsburgh is presented and three issues in this case which still persist are summarized. These are the focus on cure rather than prevention, the difference in perceptions of economic necessity and municipal financial limitations, and the different opinions on the social benefit of water quality standards. (Titus-FRC)
W81-00407

UNDERGROUND RESERVOIRS CAN CONTROL STORMWATER OVERFLOWS,
Randolph and Associates, Inc., Peoria, IL.
G. Sherwood, G. Hewitt, and R. Helm.
American City and County, Vol 95, No 3, p 41-43, March, 1980. 3 Fig, 1 Tab.

Descriptors: *Storm runoff, *Waste water treatment, *Storm drains, *Biological oxygen demand, *Water storage, Costs, Illinois, Water pollution, Water quality, Storage tanks, Reservoir storage, Combined sewers, Municipal water, Underground storage, Planning, Design, Settling basins, Remote control.

A system of in-system storage and off-line tanks for storm-water storage to help control discharges into the Illinois River from Peoria has been designed The plan recommends the use of underground covered storage reservoirs at eight locations with, where possible, remote control regulators. The level of control provided for in this system is an estimated 88% capture of the average annual overflow BOD. Spending twice the proposed investment would have resulted in removing only about 10% more BOD. For small storms, the in-system storage will be sufficient. If runoff continues after the in-system storage has been used up, the basin inlet gate will open to allow flow into the basin. If the storage capacity of Unit 1 is exceeded, Unit 2 will serve as the settling basin for flows up to the state requirement of at least 10 times Dry Weather Flow (DWF). If high runoff rates continue when the basin is already full, the operator may use both units as settling basins. Operating in this mode, at least 20 times DWF can be treated. This stormwater control project has been 'pre-certified' as an innovative/alternative technology by EPA and qualifies for 85% funding. (McKeon-FRC)
W81-00417

WATER FILTER DESIGN: WHAT TO LOOK FOR IN THE EIGHTIES,
K. Grover.
American City and County, Vol 95, No 6, p 39-40, 42-43, June, 1980. 6 Fig.

Descriptors: *Water treatment, *Filtration, *Activated carbon, *Filters, Flocculation, Water purification, Design, Coals, Odor, Taste, Turbidity, Sands, Organic wastes, Carbon filters.

Filter bed design is discussed with emphasis on depth of the filter box, contact time, granular activated carbon (GAC), anthracite beds, and coagulant control. Taste and odor is generally considered to be controlled in 3-4 min in a carbon bed as deep as a conventional coal bed (2-3 ft), and carbon regeneration need only be done every 2 or 3 yr when it is used for this purpose. Estimates, however, for the removal of synthetic organic contaminants range from 10 to 30 min, and most existing filter beds are not deep enough to allow

such long detention times. Studies in Australia have shown that 3 ft of anthracite coal in the filter achieved better turbidity removals than did 2 ft, but layers deeper than 36 inches did not perform significantly better than the 3-ft bed. Philadelphia has found that only the first 12 inches of carbon was active in their GAC filters, suggesting a similar limitation of optimum depth. Pilot tests at the Connecticut Water Company between GAC-sand-gravel, dual- and mixed-media filters have found that at a 6.0 gpm/sq ft filtration rate, the GAC-sand filter performed best. (McKeon-FRC)
W81-00422

DISINFECTION OF WATER TANKS,
A. T. Palin.
Water Services, Vol 84, No 1014, p 515-517, August, 1980. 2 Tab.

Descriptors: *Disinfection, *Chlorination, *Water tanks, *Cleaning, Water purification, Potable water, Chlorine, Bacteria, Microorganisms, Pathogenic bacteria, Costs, Water treatment, Measurement, Water quality control.

During cleaning, water-holding tanks are routinely flushed with heavily chlorinated water (about 10 mg/liter), which is then allowed to stand in the tank for about 2 hr. Residual chlorine in the tank should be 1 mg/liter, and the tank should be covered to prevent subsequent water pollution. This process is effective in eliminating pathogenic microorganisms. Suspended particulates in the rinse water may protect bacteria from the effects of the disinfectant, so it is vital to use clean water. Chlorine is the most widely used disinfectant for drinking water. To evaluate costs of commercial chlorine preparations, knowledge of their available chlorine content is necessary. Chlorine gas is suitable for large-scale use. Solutions contain the chemical form hypochlorite and their available chlorine content is up to 15%. Solid hypochlorites are generally produced as calcium compounds. Chlorinated lime has an available chlorine level of 30-35%. High Test Hypochlorite, a solid calcium hypochlorite in free-flowing granular or tablet form with a long shelf life, has an available chlorine content of 65-70%. Formulas for calculating the amount of disinfectant to be used are presented. To measure the amount of residual chlorine in a water supply, either the DPD or Chlorocol method may be employed. In the DPD method, the Lovibond comparator is used for comparison of the color of water samples, while the chlorocol one-tablet test is a simplification of the DPD method. These disinfection procedures may also be used for water mains and small reservoirs. Bacteriological tests may be performed to confirm disinfection. (Geiger-FRC)
W81-00424

PLANNED PROCESSING BEATS BACK WATER-PLANT SLUDGE DISPOSAL PROBLEMS,
Pirnie (Malcolm), Inc., Paramus, NJ.
G. P. Westerhoff, and G. C. Cline.
Water and Sewage Works, Vol 127, No 10, p 32-34, 36, 58-59, October, 1980. 3 Fig, 1 Tab, 16 Ref.

Descriptors: *Sludge disposal, *Pretreatment(Water), *Coagulation, *Dewatering, Flocculation, Suspended solids, Settling basins, Recycling, Solid wastes, Soil conservation, Reservoirs, Filtration, Water treatment, Costs, Sewage lagoons, Water sources, Water softening, Mechanical equipment.

Water treatment plant waste handling and disposal is becoming more expensive and difficult. Many plants can no longer discharge untreated sludge, but an acceptable method of solids disposal can cost 50% of the plant's operating budget. The objective of waste treatment should be to minimize the solids produced and to maximize the treatability of waste solids. During pretreatment, the possibility of developing new water sources with less turbidity, color, and/or hardness should be considered. Control of suspended solids through nutrient control and soil conservation can reduce solids production in reservoirs. Coagulant dosages can be reduced by optimizing the order of chemical additions, mixing, and flocculation. In softening plants, the quantity of sludges may be minimized by reducing the amount of chemical addition. Sludge collection is usually via sedimentation basin, from which solids are removed manually or mechanically. Filter backwash is treated by the storage and collection of solids in lagoons or liquid-solids separation basins with discharge of the supernatant or, alternatively, by recycling without solids removal (achieving zero discharge). The current trend in sludge treatment is toward dewatering by nonmechanical means because of the low cost. Where mechanical dewatering is cost effective, the trend is to use pressure filters for coagulant sludges and vacuum filters for lime-softening sludges. The use of regional sludge treatment may increase in the future. The development of new technologies in this area is necessary. (Gish-FRC)
W81-00438

REMOVAL OF ORGANICS IN WATER USING HYDROGEN PEROXIDE IN PRESENCE OF ULTRAVIOLET LIGHT,
Health and Welfare Canada, Ottawa (Ontario). Monitoring and Criteria Div.
M. Malaiyandi, M. H. Sadar, P. Lee, and R. O'Grady.
Water Research, Vol 14, No 8, p 1131-1135, August, 1980. 4 Fig, 2 Tab, 15 Ref.

Descriptors: *Water purification, *Ultraviolet radiation, *Oxidation, Organic wastes, Ozone, Gas chromatography, Water treatment, Analytical techniques, Laboratory tests, Potable water, Research and development.

Optimum conditions for the removal of dissolved organics from water intended for drinking or for high-purity research purposes were investigated using hydrogen peroxide and ultraviolet (UV) light as the purification techniques. When hydrogen peroxide is used under UV light, cleavage of the 0-0 bond yields hydroxyl (OH) radicals which are extremely reactive with most organic molecules with H-atom donor properties. In the present study, reactive OH radicals were generated in tap and distilled water samples using UV light of wavelength above the 200 nm system and a 50% hydrogen peroxide solution. The photochemically initiated OH radical oxidation decreased the total organic carbon (TOC) content of distilled water samples by about 88% and the TOC content of tap water by about 98%. Gas chromatographic analysis of hexane extracts of distilled and tap water samples before and after treatment for organic removal showed that approximately 12% of the electron-capturing residual organics were still present after hydrogen peroxide/UV light treatment. These findings show that water may be rendered nearly free of organic impurities by this relatively simple but efficient method. (Geiger-FRC)
W81-00498

5G. Water Quality Control

FURTHER INVESTIGATIONS OF ALUMINA-LIME-SODA WATER RECOVERY APPLICATIONS,
Midwest Research Inst., Kansas City, MO.
J. W. Nebgen, and G. D. Hinshaw.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127326, Price codes: A04 in paper copy, A01 in microfiche. Final Report for Office of Water Research and Technology. October, 1980. 59 p, 5 Fig, 27 Tab, 6 Ref. OWRT-C-90005-S(No 9504)(1), 14-34-0001-9504.

Descriptors: *Water purification, *Trace elements, *Water chemistry, *Laboratory tests, *Water treatment, *Alkalinity, Analytical techniques, Research and development, Water analysis, Aluminum, Chemical reactions, Lime, Arsenic compounds, Chromium, Sulfates, Sulfur compounds, Inorganic compounds, Hydrogen ion concentration.

Findings of a laboratory study undertaken to define the range of applications of the alumina-lime-soda process have been reported. This process was effective for the removal of calcium sulfate at pH 12, and for the removal of dissolved silica in the pH range of 8.5-9 in earlier studies reported by Midwest, while emphasis of the present study was directed towards removal of trace constituents in water. The study findings revealed that oxygenated anions of toxic elements such as arsenic, selenium, and chromium (VI) behaved similarly to sulfate, and could be removed by alumina-lime-soda at pH 12. It was observed that borate ion could also be removed at pH 12, but only in the presence of sulfate. Furthermore, phosphate and color due to dissolved organic matter can be removed in the 8.5-9 pH range, using the same conditions as for removal of dissolved silica by alumina-lime soda. Heavy metals such as copper and zinc were also removed under these conditions. Mechanisms for removal of solutes by aluminum species generated during alumina-lime-soda treatment have been postulated. (Zielinski-IPA)
W81-00316

CONTROL OF POLLUTION IN WATERS CONTAINING HEAVY METALS,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
D. F. Kincannon, M. H. Bates, and R. N. DeVries.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124133, Price codes: A05 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University, Completion Report, September, 1980. 87 p, 31 Fig, 5 Tab, 64 Ref. OWRT-A-087-OKLA(1), 14-34-0001-8038.

Descriptors: *Heavy metals, *Water pollution sources, Lead, Chromium, *Pollutants, *Water pollution control, Water pollution, *Waste water treatment, Chemical wastes, Metals, *Oklahoma, Chemical reactions, Chemical precipitation, Pollutant identification, Analytical techniques, Activated sludge, Biodegradation, Soils, Soil chemistry, Sediments, Soil types.

An integrated set of experiments were carried out on the fate of chromium and copper in biological waste water treatment processes, aqueous environments, and soil systems. A rotating biological contactor and activated sludge were used as the waste water treatment processes; Stillwater, Oklahoma area lake and river water and sediments, as the aqueous environments; and sandy and red silty clay soils, as the soil systems. While it was determined that chromium was removed by the lake and river sediments but not generally removed by biological treatment processes or by algae, it was found that copper was removed by all systems. Removal efficiencies of the metals were highly dependent upon operating and environmental conditions. Sediments and soils had strong affinities for copper, and uptake could be correlated with soil type. Soluble copper reduction in aquatic systems occurred by precipitation. In general, the results indicated that copper is probably of less environmental concern than chromium since it is so readily removed by all systems studied. Heavy metal contamination of the environment can be minimized by proper management practices. Reduction of copper and chromium pollution in aqueous environments were deemed attainable by correct treatment choices, and an understanding of their fate in aqueous systems. (Zielinski-IPA)
W81-00323

SCALE REDUCTION IN PHYSICAL HYDRAULIC MODELS OF THERMAL DISCHARGES,
Clemson Univ., SC. Water Resources Research Inst.
B. L. Sill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-126526, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No 90, September 1980. 146 p, 31 Fig, 18 Tab, 19 Ref, 6 Append. OWRT-B-119-SC(1).

Descriptors: *Electric powerplants, *Thermal water, *Heat transfer, *Hydraulic models, *Water cooling, Physical hydraulic modeling, Thermal discharges, Scale reducting, Surface heat transfer, Surface heat exchange coefficients, North Carolina, Belews Creek Stream Station(NC), *Lake Belews(NC).

An experimental procedure is developed to study the behavior of the water-air heat transfer in indoor physical hydraulic models of thermal discharges. Using this procedure, the value of the indoor heat exchange coefficient is determined and used to calculate the allowable distortion of scale in a far field thermal discharge model. In preparation for an actual model study, scaling requirements were reviewed for the following far field processes: (a) convective spread, (b) turbulent dispersion, (c) head loss, and (d) surface cooling. The necessary distortion of scale differs for each of the different mechanisms, forcing researchers to ignore those that are less important. The theory and procedures developed were tested by modeling Lake Belews, a thermally loaded lake near Winston Salem, N.C. Because of limits to the allowable distortion of the vertical to horizontal scale ratio in the model, only a portion of the prototype could be modeled, emphasizing the need for a way to increase the allowable distortion by enhancing the water-air heat transfer in the indoor model. Results indicate that the proposed enhancement technique allows an increase in prototype area modeled and retains satisfactory accuracy of isotherm position and magnitude.
W81-00327

A ONE-DIMENSIONAL, STEADY-STATE, DISSOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR THE WABASH RIVER, HUNTINGTON COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Di.
For primary bibliographic entry see Field 5B.
W81-00354

METHOD FOR BRINGING NUTRIENT-RICH WATER FROM THE APHOTIC ZONE OF THE OCEAN TO THE PHOTIC ZONE,
For primary bibliographic entry see Field 3A.
W81-00367

DEBRIS SEPARATION AND DISPOSAL SYSTEM,
A. J. Aman.
U.S. Patent No 4,189,386, 12 p, 16 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 991, February 19, 1980.

Descriptors: *Patents, *Water pollution, *Water pollution treatment, Water quality control, Industrial water, Powerplants, *Intakes, Filters, Debris.

A system for the removal and disposal of debris from the water intake of power plants or the like is disclosed. The system includes a strainer basket having pivoted, separable sections movable from an abutting position to an open position. The sections are biased to the abutting position by gravitational forces acting upon the basket sections and their contents. The system further includes structure for opening portions of the basket to empty the contents into a suitable disposal recepticle. The opening device is positioned on the debris-receiving receptable and has cam surfaces for separating the basket sections. The object of this invention is to provide a bottom-emptying straining device which does not require latches or other mechanical fasteners to secure it in the closed position during straining and which will operate during freezing weather without the need for artificial heating. (Sinha-OEIS)
W81-00371

NOVEL COMPOSITIONS OF MATTER FOR USE IN THE TREATMENT OF AQUEOUS SYSTEMS,
Ciba-Geigy Corp., Ardsley, NY. (Assignee).
P. Miles, N. Richardson, and M. A. Finan.
U.S. Patent No 4,189,383, 6 p, 2 Tab, 12 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 990, February 19, 1980.

Descriptors: *Patents, *Water treatment, *Scaling, Water quality control, Industrial water, Chemical reactions, Hydraulic systems, Telomers.

The invention relates to telomeric compounds which show good control of calcium carbonate, calcium sulphate and magnesium hydroxide scales and more importantly modify the crystal structure of the scale so that it is non-uniform and easily removable. A method is provided for inhibiting scale formation from aqueous solutions over a wide range by adding a minor proportion of a product comprising a telomer of a formula which is disclosed. Examples illustrate how the formula may be used. (Sinha-OEIS)
W81-00373

WATER SOFTENING SYSTEM,
J. W. Braswell.
U.S. Patent No 4,181,605, 10 p, 10 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 990, No 1, p 249, January 1, 1980.

Descriptors: *Patents, *Water treatment, *Water softening, *Demineralization, Iron exchange resins, Water quality control, Flow control, Instrumentation, Equipment, Backwash, Regeneration.

The water softening system employs a treatment tank containing a mineral bed of ion-exchange resin granules, a brine tank, and a valve for periodically cycling water through the mineral bed for removing hardness and other undesirable factors. A diluted brine solution is passed through the bed in a opposite direction to its normal service flow to recondition and flush the bed. The control for the system includes electrically operated solenoid diaphragm valves, and a plunger valve responsive to water pressures, for controlling and regulating the flow of water and brine through the mineral bed. A venturi aspirator is incorporated in the plunger valve, so that a saturated brine solution is drawn and with controlled dilution is caused to flow in a direction opposite to service flow through the mineral bed. (Sinha-OEIS)
W81-00377

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

MAXIMIZING THE UTILITIES OF SOCIAL CRITERIA FOR URBAN WATER MANAGEMENT AND PLANNING,
For primary bibliographic entry see Field 6B.
W81-00264

WATER RESOURCES OF THE RIO GRANDE AN INTERDISCIPLINARY APPROACH,
New Mexico State Univ., Las Cruces.
R. R. Lansford.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 59-63. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *New Mexico, *Rio Grande, *Water management(Applied), *Water resources, *Project purposes, Project planning, Resources, Management, Coordination, Creativity, Project feasibility, Universities.

The strengths and results of interdisciplinary research were identified, regarding their application to water resources conservation, allocation and management in the Rio Grande area of New Mexico. Three projects were used as examples to illustrate how as many as seven different departments of three universities and scientific institutions developed the projects. The projects started from brainstorming sessions, progressed to the formative stages, were funded and produced successful results. The successful project format included using an advisory committee of diverse state and federal agency representatives, that met with the research staff on technical and policy questions. A contributing factor to the success of the projects was the dialogue brought about by research meetings that allowed members to receive technical language differences, and to develop meaningful task direction. The project results were methodology and criteria that can be applied to water management projects in similar semi-arid areas in the United States and the world. (Meade-Omniplan)
W81-00394

FEDERAL WATER LEGISLATION,
Senate Committee on Environment and Public Works (U. S. Senate).
H. Brayman.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 181-191. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *Legislation, *Water resources development, *State governments, *Planning, *Water policy, Expenses, Economic impact, Construction costs, Jurisdiction, Administrative agencies, Equitable apportionment, Projections

Federal spending for water resources projects is down about 50% from the mid-sixties. There are no priorities in the program; project selection is basically on an 'ad hoc' basis. Public support for water development programs is very low. Senator Peter Domenici development 3 criteria to improve the system: (1) try to find a way to put more money into the program; (2) create a system to select priorities; (3) broaden the constituency. Domenici introduced Bill S1241 which was later amended to 1660. The object of S1241 was to remove Congress from the individual selection and appropriation of projects; each state would perform that function. Four billion dollars a year for construction was allocated, to be distributed on a formula based half on the population of a state and half on land area. Amendment 1660, adopted by the Senate subcommittee on water, is a 5 year demonstration of the block allocation described in S1241, but with an allocation of $1 billion a year. This system would work in tandem with the existing line-item approach and provide a basis for future comparisons of the systems. No major project bills are expected in the next year. Some federal compromises might include: (1) more projects; (2) variation(s) on the Domenici-Moynihan block allocation system; (3) changes in the cost-sharing process in developing water projects. (Atkins-Omniplan)
W81-00399

6B. Evaluation Process

STORMWATER MANAGEMENT IN THE UNITED STATES A STUDY OF INSTITUTIONAL PROBLEMS, SOLUTIONS AND IMPACTS,
Stormwater Consultants, Bolingbrook, IL.
For primary bibliographic entry see Field 4A.
W81-00263

MAXIMIZING THE UTILITIES OF SOCIAL CRITERIA FOR URBAN WATER MANAGEMENT AND PLANNING,
D. W. Hill
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121055, Price codes: A11 in paper copy, A01 in microfiche. Completion Report to Office of Water Research and Technology, September 1980, 89 p, 12 Fig, 4 Tab. OWRT-C-4222(No 9033)(1), 14-31-0001-9033.

Descriptors: *Attitudes, *Social participation, *Regression analysis(R-sort), *Data processing, *Data retrieval, Social aspects, Statistical methods, Probability, Water planning, Watermanagement, Sampling, Social aspects, *Space-distance model, Factor score, Control point, Q-sort, Communications, Goal structure, Factor analysis

A research effort was mounted to develop and test social criteria for effective use in the water management and planning community. The research design employed a space-distance model which

involved factor analytical software for comparing empirical data generated from five community household samples. The machine output was then used to assess data relationships and to identify those social variables (i. e., those control points) which channel and direct other variables. Research results indicated: (a) that factor scores from Q-Sort factor analysis programming offer the water management and planning community a ready means for estimating, (i) interactive effects among social variables and (ii) which variables are the most probable controllers; (b) that presently, problems stemming from the softness of social data will be more effectively addressed by increasing quality control on data retrieval before increasing statistical refinement; (c) that action and communications variables as well as overall life goal structures appear to be strong candidates for control points; and (d) that effective action and communications patterns need to be distinguished sharply from affective action and communications patterns.
W81-00264

TENNESSEE-TOMBIGBEE CORRIDOR AREA: GROWTH FORECASTING AND MANAGEMENT,
Army Engineer District, Mobile, AL.
A. V. Galdis.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 15-17 (1979) 3 Fig.

Descriptors: *Tennessee-Tombigbee Waterway, *Economic impact, *Regional economics, *Social impact, Employment, Social change, Planning, Management, Inland waterways, Kentucky, Tennessee, Alabama, Mississippi.

The area to be economically affected by the construction of the Tennessee-Tombigbee Waterway encompasses 48 counties in Alabama, Kentucky, Mississippi, and Tennessee and covers 29,300 square miles from the Ohio River to the Gulf of Mexico. Three Congressional resolutions were issued authorizing the Corridor Study to aid local communities, counties, and agencies with their planning needs. The economic studies are organized into two phases with several tasks in each phase. Phase One, the Pilot Studies, uses existing county level impact assessment models for four counties to analyze data needs for the investigations of the entire area. The two models used in this phase are the Economic Impact Forecasting System (EIFS) and the Social and Economic Assessment Model (SEAM). After the selection of analysis tools in Phase One, Phase Two, the studies for all 48 counties, will begin. Meetings will be held at planning agencies throughout the area to explain the analyses to residents and officials. Due to the high number of equally well-endowed sites along the waterway for industry, it is likely that site selection will be based on the will and ability of an area to solve problems associated with that site. (See also W81-00290) (Seigler-IPA)
W81-00294

INCOME DISTRIBUTION AND WATER RESOURCE PROJECTS: TESTING THE CLASSICAL THEORY OF ECONOMIC DEVELOPMENT,
Mississippi State Univ., Mississippi State. Dept. of Economics.
B. J. Eatherly.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 19-21 (1979) 4 Ref.

Descriptors: *Regional economics, *Social impact, *Economic impact, Social change, Income distribution, Employment, Income analysis, Wages, Social values, Labor, Labor mobility, Employment opportunities, Capital, Land tenure.

Large-scale water resource projects provide something of a controlled social experiment and are an excellent opportunity for social scientists to learn more about the benefits and costs of industrial growth. Water resource projects produce a sudden flow of construction activity and ultimately change the sales and purchase opportunities for the residents of the area. Economic growth and its effect on social classes can be approached from the classical viewpoint of a closed society. Ownership arrangements in a society are important when the basis of economic growth is the production of a resource. Classical economics defines three groups of resources, land, labor, and capital. Classical economics are used to discuss these groups and their attitudes toward events such as a large-scale water project. It appears that contrary to the economic assessment, capitalists and laborers tend to favor such projects while landowners do not. A consideration of short-vs-long-run benefits or external effects can help to explain these attitudes. A brief discussion of labor migration is included. (See also W81-00290) (Seigler-IPA)
W81-00295

A FIELD TEST OF ENVIRONMENTAL IMPACT ASSESSMENT IN THE TENSAS BASIN,
Mississippi State Univ., Mississippi State. Dept. of Anthropology.
J. H. Peterson, C. A. Clinton, and E. Chambers.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 27-32 (1979) 1 Fig, 5 Tab, 2 Ref.

Descriptors: *Louisiana, *Environmental effects, *Economic impact, *Social impact, Regional development, Planning, Regional analysis, Flood control, Channel improvement, Tensas River, Anthropology, Ecology, Engineering, Alternative planning.

A field test of Water Resources Assessment Methodology (WRAM) procedures was conducted at the Tensas River Basin project in northeastern Louisiana. WRAM is a procedure for assessing and evaluating impacts in the areas of economic development, environmental quality, regional development, and social well-being. The Tensas River Basin has a flooding problem and the project calls for extensive channel improvements along 99 miles of the river. Five alternative plans and a 'no action' alternative are being considered. WRAM requires the formation of an interdisciplinary team representing the areas of ecology, economics, engineering, and sociology/anthropology. A preliminary list of mandatory and critical variables is assembled and the variables are weighted. Data are then collected and analyzed for impact projection and sealing. Finally a summary table is constructed for each account listing each variable and its weight and impact for each alternative. It is concluded that the Tensas study was a useful test of the WRAM procedures. The use of the interdisciplinary team proved to be quite successful in that it allowed division of labor, a system of checks and balances, and duplication of effort was minimized. (See also W81-00290) (Seigler-IPA)
W81-00297

ANALYSIS OF RISK IN USING LAKE WATER SUPPLIES FOR SALMON HATCHERIES IN ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
P. M. Fox, and R. F. Carlson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124125, Price codes: A02 in paper copy, A01 in microfiche. Completion Report 77-22-C, August, 1980. 18 p, 6 Fig, 7 Ref, 1 Append. OWRT-A-063-ALAS(1), 14-34-0001-8002.

Descriptors: Risks, Uncertainty, Analytical techniques, *Mathematical models, *Water supply, *Lake fisheries, *Alaska, *Salmon, Operations research, Computer models, Mode studies, Statistics, Statistical methods, Analysis, Lakes, Facilities, Estimating, Forecasting, Planning, Water resources.

The primary study objective of analyzing the risk of using northern lakes as a water supply for an extensive salmon hatching program was carried out by means of five sub-objectives. These ranged from the analysis of water supply needs of proposed salmon rehabilitation facilities with acceptable uncertainties in water quality parameters of established criteria; to use of the authors' northern lake model; to use of Baysian decision analysis techniques for risk and failure estimates. Planning strategies were considered. Lack of ample data imposed some limitations. It was concluded that it is possible to estimate basin streamflow with very little data. The reported method provided a viable solution. The developed methods can be used with spot discharge measurements and general information on the hydrologic pattern. This was the most common data situation. The results have potential benefit to those in coastal Alaska needing streamflow and lake water estimates, and provide an example of methods for incorporating risk and uncertainty into deterministic models. (Zielinski-IPA)
W81-00313

AN ECONOMIC ANALYSIS OF THE EFFECTS OF REGULATORY DELAY ON NUCLEAR POWER PLANT CONSTRUCTION,
Clemson Univ., SC. Water Resources Research Inst.
M. T. Maloney, and M. D. Walsh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124422, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No 89, August 1980. 78 p, 3 Fig, 33 Ref, Append. OWRT-A-042-SC(1).

Descriptors: *Construction costs, *Nuclear powerplants, *Cost analysis, *Construction delay costs, Model studies, Economics, Governments, Regulation, Cost-benefit analysis.

In order to evaluate the impact that any government regulation has on society, an accurate measure of the costs imposed by the regulation is essential. Current government estimates of the cost of pollution control legislation have failed to include the costs of project delays that firms may experience when complying with such standards. Clearly, if these delays are the direct result of such legislation their costs should be included for a proper evaluation. The purpose of this report is to define and measure the true impact that construction deals have on the total project costs of a specific industry. The Nuclear Power Industry has been chosen to illustrate the problem. First, the industry is examined in terms of its economic and physical environment. A model is then developed to deal with the costs involved in the construction of a typical nuclear plant. The model is tested by regressing time and cost data of 31 completed plants to determine the impact that unanticipated delays have had on total project costs. These results indicate that such delays would increase the total project costs of a typical 1,000 mw plant by .8 percent per month in the initial stage of the project and 1.1 percent per month after actual construction begins.
W81-00328

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ESTIMATING IRRIGATION WATER QUANTITY AND QUALITY,
California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W81-00271

WATER CONSERVATION ALTERNATIVES FOR THE NORTH,
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
For primary bibliographic entry see Field 3D.
W81-00384

WE INSTALL OUR OWN WATER MAINS,
Valparaiso Dept. of Waterworks, IN.
For primary bibliographic entry see Field 8A.
W81-00433

6D. Water Demand

ESTIMATING IRRIGATION WATER QUANTITY AND QUALITY,

California Univ., Davis. Dept. of Civil Engineering.
O. J. Helweg, and D. Alvarez.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 106, No IR3, Proceedings Paper 15712, p 175-188, September 1980. 13 Fig, 4 Tab, 6 Ref, 2 Append. OWRT A-060-CAL(3).

Descriptors: *Irrigation water, *Water demand, *Water supply, *Pricing, *California, Costs, Economics, Water management(Applied), Irrigation, Demand, Water quality, Salinity, Water values, Crops, Citrus fruits, Semiarid climates, Agriculture, Available water.

The value of water quantity and quality is shown by its demand curve (surface); but because the market for water is imperfect, the demand surface must be derived by other means. This paper shows a theoretical process for determining the derived demand surface for both water quantity and quality, using data for citrus crops in California. The results show that for the relevant price range, the demand for water quantity is relatively inelastic, indicating that pricing is not an attractive mechanism for controlling water distribution; however, the demand for water quality is relatively elastic which makes pricing a possible means for managing water quality. The results also support the claim that the value of water is considerably more than most irrigators pay for it. (Sims-ISWS)
W81-00271

6E. Water Law and Institutions

INDUSTRIAL COST RECOVERY: WHY IT SHOULD BE KILLED,
Philadelphia Water Dept., PA.
C. Guarino.
American City and County, Vol 95, No 6, p 57-59, June, 1980. 1 Fig.

Descriptors: *Industrial wastes, *Industrial water, *Municipal wastes, *Industrial Cost Recovery program, *Clean Water Act, Waste water treatment, Water conservation, Legislation, Industrial plants, Municipal water, Treatment facilities, Economic efficiency, Use rates, Water pollution.

The author recommends that the Industrial Cost Recovery (ICR) program, developed to avoid government subsidy of industrial water cleanup under the Clean Water Act of 1972, be discontinued because it has failed to meet its objectives and has become a hindrance to the implementation of the Clean Water Act. ICR was developed to ensure that no unfair competitive advantage would result from a company being connected to a municipal water system rather than treating its own wastes, but evidence indicates that this is a rare occurrence and that the imposition of ICR charges has in some cases resulted in companies withdrawing from municipal systems. ICR was also established to prevent the funding of municipal treatment systems with too much capacity due to the overestimation of industrial contributions, but this can be achieved through other channels, such as EPA grant regulations. Thirdly, ICR was designed to encourage industry to conserve water and to produce less waste water, but in industrial users do not cite ICR payments as a reason for conserving water. In addition, ICR is considered an inefficient way to collect revenue for local government, the management of local ICR systems is expensive, pretreatment programs are reducing the qualitative differences between industrial and domestic discharges so that there is no reason for industrial users to pay an extra charge, user charge systems are more efficient than ICR, municipalities with approved ICR systems have not elected to use them, and ICR does little for pollution control. (Gish-FRC)
W81-00259

TIME FOR A NEW CLEAN WATER PROGRAM,
R. A. Pavia.
American City and County, Vol 95, No 6, 53-54, June, 1980. 1 Fig.

Descriptors: *Clean Water Act, *Government finance, *Local governments, *Federal government, *Water pollution control, Legislation, Municipal water, Governmental interrelations, State governments, Waste water treatment, Costs, Use rates, Environmental Protection Agency, Administrative agencies.

The author considers that one way of limiting federal spending would be to return the Clean Water program to the local agencies responsible for the cleanup, as they can borrow money inexpensively through tax-free municipal bonds. Several program modifications are suggested to alleviate problems such as lack of funds and failure of new treatment plants to meet program specifications. These include authorizing funds for a 5-yr continuation of the waste water treatment grant program with a change in matching ratio to 67% federal-33% local, spelling out long-range objectives of the program, which will have waste-water agencies functioning as utilities responsible for operating and maintenance costs as well as financing new or replacement facilities, legislating mandatory reviews of existing water quality standards, and encouraging consolidation or regionalization of waste-water systems. The author also recommends establishment of a treatment technique advisory committee, accelerating dissemination of data, establishing teams of experts to recommend reforms to facilities not meeting performance standards, setting higher priorities for treatment applications or making projects in unsewered areas ineligible, considering making ineligible tertiary treatment projects and sewer-related projects, and re-evaluation of the role of each level of government The author stresses that the separation between the three levels of government should be restored; the sewerage construction grants program should be assigned to the states, and local government should be granted more freedom. (Gish-FRC)
W81-00260

GROUND WATER MINING AND WESTERN WATER RIGHTS LAW: THE NEBRASKA EXPERIENCE,
Nebraska Univ., Lincoln.
J. D. Aiken, and R. J. Supalla.
South Dakota Law Review, Vol 24, No 3, p 607-648, Summer 1979. OWRT B-045-NEB(No 8098)(1).

Descriptors: *Nebraska, *Groundwater mining, *Groundwater availability, Water rights, Groundwater, Legislation, Irrigation, Water allocation(Policy), Water users, Administrative agencies, Water conservation, *Groundwater management(Applied).

Depletion of ground water supplies due to irrigation is one of the major water policy questions facing the western states. Traditional responses have included ignoring the problem, or utilizing a supplemental water supply. Regulating ground water withdrawals has not been implemented, because it is perceived as too politically controversial. The 1975 Nebraska Ground Water Management Act (Act) is among the first administrative attempts to significantly reduce ground water withdrawals. The Act gives each local Natural Resource District (NRD) the option of regulating ground water use through the establishment of ground water control areas. Ground water controls authorized by the Act include: (1) well spacing restrictions; (2) rotation of pumping restrictions; (3) ground water allocation by establishing what quantities may be withdrawn; and (4) well drilling moratoria. In addition, an NRD may adopt other reasonable ground water controls. The Act also requires NRD's to establish and enforce regulations to control runoff from ground water irrigation. The blend of local and state responsibilities implicit in the Act has led to cooperation among state and local natural resource agencies and to an increased awareness of various aspects of ground water management. (Wilson-Florida)
W81-00269

INDIANA FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN, FISCAL YEARS 1982-1986,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121253, Price codes: A07 in paper copy, A01 in microfiche. Report submitted to Office of Water Research and Technology, 1980. 125 p, 2 Tab, 7 Append.

Descriptors: *Research priorities, *Indiana, *Water resources, *Water resources development, *Planning, *Water resources institute organizations, Water sources, State jurisdiction, State governments, Precipitation(Atmospheric), Hydrology, Water supply, Research and development, Groundwater, Water pollution, Water quality, Pollutants, Water reuse, Mining, Computer models.

The geographical location of Indiana is such that it receives an ample supply of water on an average annual basis through precipitation. However, substantial and generally unpredictable variations in the precipitation as the water supply source have direct and essentially immediate impacts whose seriousness depends on a number of factors. Indiana water resources problems have been categorized into six areas: (1) hydrologic and hydraulic processes; (2) planning and institutions; (3) water quality; (4) atmospheric and precipitation processes; (5) hydrologic-ecologic relationships; and (6) water supply, development and management. Fifty-three research priorities were determined for these six areas. The highest-ranked priority for each of these areas was, respectively: (1) study hydraulic characteristics of cast overburden from mined reclaimed areas; (2) improve detection, identification, decomposition, residual and trackin pollutant movements in ground/surface waters; (3) study methods of integrating flood plain management into a regional comprehensive land use planning process; (4) study ecological resonse to the seven day, one in ten year low flow design criteria; (5) develop mixed hydrologic-hydraulic computer models to forecast droughts, severe storms, and routing water through conveyances, including improved methodologies for reservoir management; and (6) evaluate direct/indirect impacts and benefits of urban water reuse applications, including industrial, agricultural, and municipal reuse. (Zielinski-IPA)
W81-00279

NORTH CAROLINA'S FIVE-YEAR WATER RESEARCH PROGRAM FOR 1982-1987,
North Carolina Water Resources Reserch Inst., Raleigh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121295, Price codes: A05 in paper copy, A01 in microfiche. October, 1980. 77 p, 6 Fig, 7 Tab, 33 Ref.

Descriptors: *North Carolina, *Research priorities, *Water quality, *Water quantity, Eutrophication, Fish kills, Estuaries, Drainage, Hydrology, Industrial wastes, Water pollution sources, Budgeting, Programs, Shellfish, *Five-year plans.

The rapid rate of industrialization, urbanization, and power growth in North Carolina has produced three major study and research areas of immediate concern: water resources planning and management, water quality management, and water quantity management. North Carolina's Water Resources Research Institute has selected these areas for the focus of its future concern. In water resources planning and management, estuaries and their develoment are a high priority due to the State's 2.2 million acres of estuaries. Fish kills, algal blooms, and shellfish water closings will receive atention in water quality research. Water quantity management will be highly concerned with hydrology and drainage. In all three research areas technology transfer will also be a priority The Institute will sponsor research based on relevancy to priority problems and scientific merit. Additional high priority areas include instream flow needs, energy/water relationships, stormwater management, pollutant identification, industrial wastes, groundwater pollution, and water quality standards. Recreation and irrigation are considered low priority research areas. Tables of proposed distribution of funds by budget activity and priority level are given for each year in the five-year program. (Seigler-IPA)

W81-00280

A 1982-87 RESEARCH PROGRAM FOR THE UNIVERSITY OF ILLINOIS WATER RESOURCES CENTER,
Illinois Univ. at Urbana-Champaign. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121287, Price codes: A05 in paper copy, A01 in microfiche. Report submitted to Office of Water Research and Technology, October 13, 1980. 81 p, 2 Fig, 10 Tab.

Descriptors: *Illinois, *Research priorities, *Water allocation(Policy), Water quality, Water quantity, Budgeting, Eutrophication, Water pollution sources, Erosion, Flooding, Water shortages, Ecosystems, Floodplains, Silting, Irrigation water, *Five year plans.

Nine critical water problems are identified for Illinois: depletion of aquifers, lake siltation, sediment pollution, potential groundwater contamination, long-term health effects of water contamination, inadequate water treatment technology, the possible destruction of ecosystems, future irrigation demands, and the statewide diffusion of water authorities. Other problems are considered urgent such as: rural flooding, the lack of authority over floodplain management, advanced water treatment plant costs, regional water competition, and inefficient sewer designs. Problems classified as important are: urban flooding, water shortages, new water sources augmentation, water distribution system conservation, agricultural chemical pollution, hazardous wastes disposal, and channel conveyance legal problems. Precipitation in Illinois is variable ranging from 32 to 46 inches annually. Surface water quality is generally good with sedimentation from soil erosion a primary nonpoint source pollutant. Groundwater quality is also generally good. The most severe water shortages in the near future will be in the area around Chicago. To solve these problems, a program of research priorities and technology transfer is described. Projected annual funding requirements and allocations by priority are given. (Seigler-IPA)
W81-00281

A FIVE-YEAR PLAN FOR WATER RESOURCES RESEARCH IN ARIZONA,
Arizona Water Resources Research Center, Tucson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121279, Price codes: A04 in paper copy, A01 in microfiche. October 1980. 68 p, 5 Fig, 13 Tab, 12 Ref, 2 Append.

Descriptors: *Arizona, *Research priorities, *Groundwater depletion, Groundwater mining, Groundwater recharge, Water conservation, Water rights, Planning, Budgeting, Water reuse, Water pollution, Efficiencies, Information exchange, Agriculture, *Five-year plans.

Arizona's underlying water resources problem is the perennial overdraft of groundwater. The legal basis of water use is largely the key to this problem, but priority research is being designed to help. Future research will be aimed at: (1) greater efficiency of agricultural, industrial, and urban water; (2) broader implementation of water conservation measures and water reuse; and (3) ways of dealing both physically and legally with the continuing groundwater recharge/depletion imbalance. Water quality problems emphasis will be placed on the protection of groundwater and surface water, and on effective methods for monitoring and maintaining water quality standards. In all research areas, information dissemination will be a priority in order to realize the full potential of the benefits from the research. Three kinds of water depletion forecasts are given to estimate Arizona's water needs for 1970-2020. Arizona has 17 problem areas classified as 'very high priority'. An extensive table is given listing the priority problems and the research tasks needed to help solve them. Also given is a table of funding allocations for the priority areas at a $125,000 annual funding level and at a $250,000 annual funding level. (Seigler-IPA)

W81-00282

VERMONT WATER RESOURCES RESEARCH CENTER FIVE-YEAR PLAN FOR WATER RESOURCES RESEARCH AND DEVELOPMENT,
Vermont Water Resources Research Center, Burlington.
M. Long, and E. A. Cassell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-123721, Price codes: A04 in paper copy, A01 in microfiche. October 1980. 53 p, 4 Fig, 9 Tab, 21 Ref.

Descriptors: *Vermont, *Research priorities, *Water resources, Planning, Acid precipitation, Water allocation(Policy), Waste water treatment, Hazards, Toxicity, Potable water, Public health, Electric power production, Surface runoff, *Five-year plan.

Vermont has identified eight priority research areas: (1) acid precipitation, (2) allocation of water resources, (3) data base for water resource management, (4) groundwater management, (5) lakes and wetlands management, (6) land runoff, (7) management of toxic and hazardous materials, and (8) waste water management and drinking water supply. Vermont has an average annual precipitation of 42 inches and is generally decentralized both culturally and hydrologically. This decentralization presents special management problems due to the economic limitations on small communities in the provision of facilities for water supply and waste water treatment. Some problems such as acid precipitation and toxic and hazardous materials management originate outside of the State and need regional research efforts. Energy production significantly impacts Vermont's water use with 70% of total use since 1975 being attributed to cooling at electric production facilities. Major factors in the State's five-year plan are vigorous technology transfer and information dissemination efforts. A generic listing of research projects and technology transfer activities considered necessary for Vermont is presented along with a table showing the interrelationships of the various program elements and the research projects. (Seigler-IPA)
W81-00283

FIVE-YEAR WATER RESOURCES RESEARCH PROGRAM,
Kentucky Water Resources Research Inst., Lexington.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121261, Price codes: A04 in paper copy, A01 in microfiche. October 1980. 66 p, 5 Tab, 22 Ref.

Descriptors: *Kentucky, *Research priorities, *Water quality, *Water quantity, Budgeting, Flood forecasting, Eutrophication, Acid mine water, Coal mines, Industrial water, Allotments, Water resources, Grants, Agriculture, Groundwater resources, *Five-year plans.

Kentucky's water resource problems are grouped into two large areas, water quntity and water quality. The State's water quality is in general good with moat streams being the calcium bicarbonate type. Kentucky has a statewide average rainfall of 45 inches per year and groundwater is plentiful in many parts of the State. Farming uses about 71 billion gallons annually; municipal, 71 billion gallons annually; and industry 220 billion gallons annually. Despite the current plentiful supply of water in Kentucky, problems do exist such as pollution, flooding, water hardness, erosion, acid mine drainage, and iron in the water. Five large priority areas with specific research needs have been selected to guide in problem solving. Those areas are: (1) coal development, which will require large amounts of water for extraction and processing; (2) hydrological extremes, flooding and droughts are regional occurrences and better forecasting and management are needed; (3) agriculture and forestry, which consume large quantities of water, and are also major sources of nonpoint pollution; (4) water quality, research is needed on siltation, eutrophication, acid rainfall, pollutant transport, and groundwater pollution; and (5) the development of water allocating strategies and industrial plant siting guidelines. A five year budgeting plan for these research priorities is included. (Seigler-IPA)
W81-00285

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT GOALS AND OBJECTIVES,
Missouri Water Resources Research Center, Columbia.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121311, Price codes: A04 in paper copy, A01 in microfiche. Report submitted to Office of Water Research and Technology, October, 1980. 70 p, 13 Fig, 7 Tab.

Descriptors: *Missouri, *Research priorities, *Water quality, *Mississippi River, *Missouri River, Irrigation water, Recreation, Sewage treatment, Flood control, Energy, Mining, Budgeting, Planning, Programs, *Five-year plans.

Missouri, a state with generally abundant but varied water resources, has selected nine priority areas for research during the next five years: (1) water quality, (2) supplemental irrigation, (3) water for recreation, (4) cutting costs of sewage treatment by reducing water use, (5) impact of energy development on water, (6) impact of mineral development on water, (7) fundamental water science, and (8) flood control. Missouri is in the western-most tier of States with a generally adequate water supply. Its two major rivers, the Missouri and the Mississippi, have a major influence on the economy of the area. Missouri has a continental climate with average annual precipitation ranging from 32 to 48 inches. Water problems are categorized in terms of the Federal Coordinating Council for Science and Engineering Technology Listing of Water Resources Research Categories. Approximately 50% of the priorities are in the water quality field, 30% in planning, and 20% in the other categories. While research in the priority areas will be encouraged, mediocre research will not be permitted just because it is in a priority area. A table is included giving estimations of the use of Annual Cooperative Funding, at two levels, in each of the priority areas for the next five years. (Seigler-IPA)
W81-00286

A FIVE-YEAR PLAN FOR WATER RESOURCES RESEARCH FOR TEXAS,
Texas Water Resources, Inst., College Station.
J. R. Runkles, and J. G. McNeely.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121303, Price codes: A05 in paper copy, A01 in microfiche. Report TR-110, October, 1980. 90 p, 5 Fig,l 9 Tab.

Descriptors: *Research priorities, *Texas, *Research and development, *Water resources development, *Water management(Applied), *Groundwater, Planning, Project planning, State jurisdiction, Water conservation, Water use, State governments, Water quality, Water supply, Flooding, Small watersheds, Water shortage, Water requirements, Water resources, Rural areas, *Five-year plans.

Present water resources uses exceed current supply by 1.2 million acre-feet (maf) and annual groundwater use exceeds the safe and firm groundwater yield by 7.1 maf. Population growth rate and its increased strain on limited water resources is a major water problem facing the State. Perceived water resources problems were categorized under flooding, groundwater depletion, water quality, and water supply and quality for small cities and rural communities. Thirteen research priorities for the Institute for the next five years were established by the Water Resources Officials Advisory Committee. The seven highest priorities were translated into specific research sub-areas and the five-year funding strategy was developed. The seven identified priorities in priority order were: (1) water conservation in agriculture; (2) drought management and related water supply disruptions; (3) groundwater management; (4) energy and water; (5) groundwater quality protection; (6) economics of surface water development and use; and

(7) flood plain management. Two-to-three research sub-areas were identified for each of the seven categories. (Zielinski-IPA)
W81-00287

THE ALLOCATION OF WATER TO INSTREAM FLOWS, VOLUME I: A COMPARATIVE STUDY OF POLICY MAKING AND TECHNICAL INFORMATION IN THE STATES OF COLORADO, IDAHO, MONTANA, AND WASHINGTON,
Lewis and Clark Coll., Portland, OR. Natural Resources Law Inst.
J. L. Huffman, M. Berry, N. Brown, N. P. Lovrich, and J. C. Pierce.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138125, Price codes: A04 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology. July, 1980. 24 p, 2 Fig. OWRT-C-80093-P(No 8403)(1), 14-34-0001-8403.

Descriptors: *Streamflow, *Colorado, *Idaho, *Montana, *Washington, Decisionmaking, *Water allocation(Policy), Water law, Surveys, Administrative decisions, Flow, Evaluation, Assessments, Information retrieval, Data collections, Water balance, Reviews, Documentation, Governments, Legislation.

This report, set out in five volumes, examined the impact of alternative institutional approaches for the allocation of water to instream flows, with particular examination of the role of technical information in State decision-making processes for Colorado, Idaho, Montana, and Washington. The study methods used structured interviews in Colorado and Idaho, unstructured interviews in Colorado, Montana, and Washington, and examinations of records of public agencies. This volume, Volume I, defined the scope of the overall study, presented the cumulative contents of the five volumes, and a preliminary comparative assessment for instream flow protection in the four States. The critique of the existing processes was a general one, applicable to most government decision-making on resource allocation issues. However, it was concluded that the problem was a very real one which States should address. Failure to separate technical and policy questions results in neither issue type being adequately addressed. Technical information cannot do more than inform policy makers of the probable consequences of alternative policies. Selection among policy alternatives can only be done on the basis of some measure of the values of the society that will experience the costs/benefits of the policy decision. (Zielinski-IPA)
W81-00317

THE ALLOCATION OF WATER TO INSTREAM FLOWS, VOLUME II: COLORADO WATER RESOURCES MANAGEMENT,
Lewis and Clark Coll., Portland, OR. Natural Resources Law Inst.
J. L. Huffman, and M. P. Berry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138133, Price codes: A07 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology, July, 1980. 97 p, 2 Fig, 24 Tab, 197 Ref, 3 Append. OWRT-C-80093-P(No 8403)(2), 14-34-0001-8403.

Descriptors: *Streamflow, *Colorado, *Water management(Applied), Water resources, *Water law, Surveys, Decisionmaking, *Water allocation(Policy), Administrative decisions, Flow, Evaluation, Assessments, Information retrieval, Data collections, Water balance, Reviews, Documentation, Governments, Legislation, Legal review.

This report represented Volume II of a five-volume report on the topic of water allocation to instream flows; the overall study also including the States of Idaho (Volume III), Montana (Volume IV), and Washington (Volume V). The overall study examined the impact of alternative institutional approaches for the allocation of water to instream flows: (1) a summary of Colorado water law with emphasis on its relation to instream flow protection; (2) results of a survey of the principal participants (judges, water referees, water lawyers) in Colorado private water rights system implementation; (3) an examination of minimum streamflow law, its history and constitutional challenges to its implementation; (4) a discussion of minimum flow law implementation; and (5) conclusions concerning operation of minimum flow law within the Colorado general appropriative rights system. Results of the survey indicated that, in general, judiciary principals were satisfied with their system of allocating water. In discussion of Colorado Senate Bill 97, it was felt that successes, from the viewpoint of those desirous of instream flow protection, have come principally from efforts of Water Conservation Board, Division of Wildlife, and Office of Attorney General individuals. (Zielinski-IPA)
W81-00318

THE ALLOCATION OF WATER TO INSTREAM FLOWS, VOLUME III: IDAHO WATER RESOURCES MANAGEMENT,
Washington State Univ., Pullman. Dept. of Political Science.
J. C. Pierce, N. P. Lovrich, Jr., and A. Cook.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138141, Price codes: A10 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology, July, 1980. 145 p, 3 Fig, 46 Tab, 179 Ref, 6 Append. OWRT-C-80093-P(No 8403)(3), 14-34-0001-8403.

Descriptors: *Streamflow, *Idaho, *Water management(Applied), Water resources, *Water law, Surveys, Decisionmaking, *Water allocation(Policy), Administrative decision, Flow, Evaluation, Assessments, Information retrieval, Data collections, Water balance, Reviews, Documentation, Governments, Legislation, Legal review.

This report represented Volume III of a five-volume report on the topic of water allocation to instream flows; the overall study also including the States of Colorado (Volume II), Montana (Volume IV), and Washington (Volume V). The overall study examined the impact of alternative institutional approaches for allocation of water to instream flows. The Idaho section (Volume III) of this report examined the role of technical information in Idaho water resources management policy-making processes, and the degree to which policy preferences of the public were reflected in preferences of political activists and Idaho State legislators. Special questionnaire surveys were conducted, with response efficiencies of 68 to greater than 70 percent. The level of information holding was found to be generally distributed across legislature, independent of political/environmental orientation of the individual members. Also, it appeared that evaluations of technical information by legislators were extremely political, with legislators trusting information derived from sources most closely matching their own. Three representative groups of attentives in the public were identified. Not only the magnitude of the differences, but the direction as well, was relatively consistent between the groups. (Zielinski-IPA)
W81-00319

THE ALLOCATION OF WATER TO INSTREAM FLOWS, VOLUME IV: MONTANA WATER RESOURCES MANAGEMENT,
Lewis and Clark Coll., Portland, OR. Natural Resources Law Inst.
J. L. Huffman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138158, Price codes: A12 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology, July, 1980. 197 p, 4 Fig, 16 Tab, 191 Ref, 7 Append. OWRT-C-80093-P(No 8403)(4), 14-34-0001-8403.

Descriptors: *Streamflow, *Montana, *Water management(Applied), Water resources, *Water law, Surveys, Decisionmaking, *Water allocation(Policy), Administrative decisions, Flow evaluation, Assessments, Information retrieval, Data collections, Water balance, Reviews, Documentation, Government, Legal review, Legislation.

This report represented Volume IV of a five-volume report on the topic of water allocation to instream flows; the overall study also including the States of Colorado (Volume II), Idaho (Volume III), and Washington (Volume V). The overall study examined the impact of alternative institutional approaches for the allocation of water to instream flows. The Montana report (Volume IV) on this study covered an examination of Montana water law; topics of minimum flow preservation under Montana law, the Yellowstone Reservation hearings, municipal reservations, agricultural applications, and instream applications; a discussion of the overall legal process; and an assessment of the future of water reservations in Montana. Twenty principal recommendations of this study were made in six categories: the law, technical issues, process design, role of the Board of Natural Resources and Conservation, reservation orders, and the reservation issue. Recommendation under the law category urged the Board continue its policy-making function in implementing the reservation statute and take a broad and aggressive approach in review of established reservations; and under technical data, such data should be format-structured to allow the Board to assess probable impacts of alternative reservation decisions. (Zielinski-IPA)
W81-00320

THE ALLOCATION OF WATER TO INSTREAM FLOWS, VOLUME V: WASHINGTON WATER RESOURCES MANAGEMENT,
Lewis and Clark Coll. Portland, OR. Natural Resources Law Inst.
N. C. Brown, and P. S. Wassenberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138166, Price codes: A05 in paper copy, A01 in microfiche Final Report to the Office of Water Research and Technology, July, 1980. 54 p, 9 Fig, 6 Tab, 104 Ref, 3 Append. OWRT-C-80093-P(No 8403)(5), 14-34-0001-8403.

Descriptors: *Streamflow, *Washington, *Water management(Applied), Water resources, *Water law, Surveys, Decision making, *Water allocation(Policy), Pacific Northwest U.S., Administrative decisions, Flow, Evaluation, Assessments, Information retrieval, Data collections, Water balance, Reviews, Documentation, Governments, Legislation, Legal review, Pacific coast region.

This report represented Volume V of a five-volume report on the topic of water allocation to instream flows; the overall study also including the States of Colorado (Volume II), Idaho (Volume III), Montana (Volume IV). The overall study examined impact of alternative institutional approaches for the allocation of water to instream flows. The State of Washington report (Volume V) on this study covered Washington State water law, past and present status of instream flows, the Western Washington Instream Resources Protection Program (WWIRPP), the controversy on protecting versus preserving fishery resources, Federal and Indian reserved rights, State resource management of the Columbia River, and the Columbia River Instream Resources Protection Program (CRIRPP). A summary of findings covering the study areas was presented. Decisions by Washington State decision-makers on instream flows appeared to be based more on scientific than political factors, but political influences were judged involved in the process (such as the Department of Energy, DOE, establishment of instream flows on streams and lakes, initiated by the Washington legislature). The rapid development and implementation of the WWIRPP and CRIRPP activities demonstrated that DOE action over the last two years has established instream flows as a high priority. (Zielinski-IPA)
W81-00321

A FIVE-YEAR PLAN FOR WATER RESOURCES RESEARCH AND ASSOCIATED TECHNOLOGY TRANSFER NEEDS,
Idaho Univ., Moscow. Water Resources Research Inst.

C. C. Warnick, and W. Reynolds.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124489, Price codes: A02 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October 1980. 22 p, 18 Ref, 1 Append.

Descriptors: *Idaho, *Research priorities, *Water conservation, Volcanoes, Irrigation water, Social impact, Environmental effects, Groundwater recharge, Energy, Wildlife, Fish passages, Planning, Water demand, Flow characteristics, *Five-year plans.

Idaho has identified five categories of research priorities: energy, irrigated agriculture, environmental, institutional and social, and water conservation. Energy related research will include the evaluation of specific pumped storage sites, new technology for moderate to low temperature geothermal water, and the development of more sophisticated river and reservoir management models. Irrigated agriculture research will include erosion control groundwater recharge, cost and energy effectiveness, irrigation practices, and irrigation facilities. Included in environmental research will be specific wildlife habitat requirements, volcanic ash impact, improved fish passages at dams, the defining of instream flow requirements, and the evaluation of Idaho lake ecosystems. Institutional and social concerns will include attitude evaluations, water right policies and laws, and the effectiveness of various administrative units. Water conservation research will include the potential for artificial aquifer recharge, the impacts of alternative water conservation policies, and improved methods for predicting irrigation water demands. Technology transfer will be a major concern in all five of the priority areas. (Seigler-IPA)
W81-00330

WATER RESOURCES RESEARCH FIVE-YEAR PLAN/1982-1987,
North Dakota Water Resources Research Inst., Fargo.
L. Lubka.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124497, Price codes: A05 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, 1980. 71 p, 1 Fig, 8 Tab, 24 Ref, 1 Append.

Descriptors: *North Dakota, *Research priorities, *Planning, *Research and Development, *Water management(Applied), *Water utilization, Wetlands, Genetics, Crop response, Groundwater availability, Waste water(Pollution), Flood plains, Flood plain zoning, Flood control, Water conservation, Water distribution(Applied), Institutions, Optimum development plans, Water policy, Water supply, *Five-year plans.

This report has outlined the water resources background of North Dakota, including geology, hydrology, meteorology, water data availability, and problem awareness. Trends in water consumption, water-related problems, and the significant recent studies concerning water and land resources were examined. Identified problem areas were: inadequate surface water supply; overdraft of groundwater; pollution of surface water; pollution of groundwater; drinking water quality; flooding; erosion and sedimentation; and wetlands. A review of these problem areas led to a ranking of seventeen North Dakota problem categories/research priorities. The highest ranked of these was flood plain management, which was the highest ranked topic for relevance to State problems, capability of State to conduct research, probability of making a significant contribution, and cost/benefit. Flood plain management was followed in ranking order by water conservation; genetic engineering of agricultural plants; waste water management; groundwater management; water distribution; stream flow; wetlands management; land-use planning; public participation/information dissemination; institutional framework; saline water; geothermal water; weather modification; nature of water; acid rain; and hydroelectric power. (Zielinski-IPA)
W81-00331

FIVE YEAR RESEARCH PLAN, 1982-1987,
Kansas Water Resources Research Inst., Lawrence.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124505, Price codes: A04 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October 1980. 67 p, 8 Fig, 4 Tab, 19 Ref.

Descriptors: *Kansas, *Research priorities, *Water conservation, *Water quality, Management, Grants, Budgeting, Pumping, Irrigation water, Enchroachment, Saline water, Toxicity, Planning, Arkansas River, *Five-year plans.

Kansas has a research program focused on water conservation, water quality protection, water management, and basic research. The State's annual precipitation averages between 17 and 40 inches depending upon location. This gives approximately 105 million acre-feet from precipitation annually. Kansas uses about 5.5 million acre-feet of its annual pumpage of 7 million acre-feet for irrigated agriculture. Aquifers are gradually being depleted as recharge is not keeping up with demand, especially in the western part of the State. Shallow wells drilled along streams have caused some, such as the Arkansas River, to cease flowing most of the year. Salt intrusion is also becoming a problem due to heavy pumping in areas such as Wichita. Conservation research will involve agriculture, industry, municipalities, recreation, wildlife, and fisheries. Water quality studies will include the sources and pathways of toxic chemicals, salt water intrusion, best management for stream quality, and sedimentation. Issues to be studied under water management include: legal and institutional aspects; economic, political, and social impacts; and interactions in hydrologic systems. It is projected that funding will go 28.6% to water conservation, 28.6% to water quality protection, 28.6% to water management, and 14.2% to basic research. (Seigler-IPA)
W81-00332

FIVE-YEAR WATER RESEARCH AND DEVELOPMENT PLAN FOR GUAM AND MICRONESIA FY 82 THROUGH FY 86,
Guam Univ., Agana. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-125122, Price codes: A05 in paper copy, A01 in microfiche. Report, submitted to the Office of Water Research and Technology, October 1980. 78 p, 9 Fig, 6 Tab, 198 Ref.

Descriptors: *Guam, *Research priorities, *Saipan, *Micronesia, Limestone, Groundwater, Islands, Planning, Projects, Pacific Ocean, Tropical regions, Hydroelectric power, Volcanoes, Waste water treatment, Water demand, *Five-year plans.

A common problem and water research priority for Guam, Saipan, and Micronesia is groundwater yield. Guam gives secondary priority to baseline water quality data and the impact of pollutants on receiving water quality. Tertiary priorities for Guam are water demand, potential conflicts over surface water use, and the feasibility of low-head hydroelectric power generation. Saipan gives secondary priority to baseline water quality data and Micronesia gives secondary priority to the operation of waste water treatment plants and conservation. Guam is within the tropical belt and is the largest of the Mariana Islands with a land area of about 212 sq mi. Northern Guam has a broad limestone plateau and the southern half is a dissected volcanic upland fringed with limestone. These limestone areas have high hydraulic conductivity and porosity. Almost all residences on Guam are served by the public water system with a total productivity from all sources of 28.5 million gallons per day. The five-year plan includes information on the problems to be researched, the five-year schedule, and the distribution of funding among the projects based on two levels of Annual Cooperative Funding: $115,000 and $250,000. (Seigler-IPA)
W81-00333

FIVE YEAR RESEARCH AND DEVELOPMENT PLAN FOR THE RHODE ISLAND WATER RESOURCES CENTER,
Rhode Island Univ., Kingston. Water Resources Center.
W. E. Kelly.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124182, Price codes: A03 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, September 1980. 28 p, 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Rhode Island, *Research priorities, *Hazardous wastes, *Urban runoff, Research facilities, Planning, Technology transfer, Flooding, Water shortages, Groundwater, Water supply, Human population, Reservoirs, *Five-year plans.

Rhode Island will focus its research on urban runoff, hazardous waste, and technology transfer. Rhode Island, the smallest State, is one of the most densely populated. Many of today's water problems are left from early industrial development based on relatively abundant waterpower. Major rivers are the Branch, the Blackstone, the Woonasquatucket, the Pawtuxet, the Potowomut, the Moosup, the Tenmile, the Warren, the Pawcatuck, and the Saugatucket. Average annual precipitation varies from 40 to 50 inches depending on location. Seventeen groundwater reservoirs have been identified. Chronic water shortages exist in the southeastern part of Rhode Island while flooding is a problem in the Pawtuxet and Blackstone River Valleys. A multi-disciplinary approach will be used to coordinate research in the areas of runoff and hazardous waste. There is very little research on-going on the number one problem of hazardous waste. Funding at two different levels is shown for the major categories and subcategories in the Five-Year Research Plan. (Seigler-IPA)
W81-00334

FIVE-YEAR PLAN FOR THE LOUISIANA WATER RESOURCES RESEARCH INSTITUTE, 1980-85,
Louisiana Water Resources Research Inst., Baton Rouge.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124190, Price codes: A02 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October 1980. 14 p, 2 Fig, 2 Tab.

Descriptors: *Louisiana, *Research priorities, *Research facilities, *Project planning, Institutions, Waste water disposal, Water conservation, Desalination, Water reuse, Water law, Environmental effects, Subsidence, Aquifer management, *Five-year plans.

Thirteen priority water research areas are identified for Louisiana: (1) effects of surface waste water disposal, (2) deep well waste disposal, (3) water conservation, (4) desalting, (5) water reuse, (6) energy-related water use, (7) groundwater, (8) aquifer management, (9) urban water, (10) environmental protection, (11) rural water, (12) water law, and (13) subsidence. A five year funding summary of the probable minimum expansion of work at the Institute is given along with a five year projection of staff and space requirements. Current research projects at the Institute totaling $349,507 include: Algae Removal by Fine Sand/Silt Filtration, Impact of Lignite Mining on Water Resources in Louisiana, Stochastic Analyses of Predictive Biochemical Oxygen Demand Kinetics, and Utilization of the Lime Byproduct from Water Softening for Waste Water Treatment. A list of 51 current Institute publications is attached. (Seigler-IPA)
W81-00335

FIVE-YEAR PLAN OF THE PUERTO RICO WATER RESOURCES RESEARCH INSTITUTE,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
R. M. Candelario.
Available from the National Technical Information

Service, Springfield, VA 22161 as PB81-126542, Price codes: A05 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October, 1980. 90 p, 21 Fig, 24 Tab, 15 Ref.

Descriptors: *Puerto Rico, *Research priorities, *Research and development, *Planning, *Water management(Applied), *Water utilization, Water resources development, Water supply, Water quality, Water reuse, Water distribution(Applied), Institutions, Water policy, Optimum development plans, Toxins, Water pollution, Water purification, Water balance, Waste water(Pollution), Basins, *Five-year plans.

Preparation of this plan has responded to the mandate of the Water Research and Development Act of 1978 (P.L. 95-467). Both surface and groundwater supplies were deemed adequate for existing/future needs, but current planning and management practices are inadequate, and water shortages often arise in the agricultural/industrial/municipal sectors. The most urgent needs in water resources research in Puerto Rico were identified as lying mainly within the general categories of management, quality and reuse of water. The identified high-priority research problems to be investigated by the Institute during the five-year period were placed under five different categories: (1) atmospheric, hydrological, and hydraulic processes; (2) hydrological-ecological relationships; (3) water quality management and protection; (4) water development, use, conservation and management; and (5) institutional and economic analysis and water resource planning. Identified high-priority research problems included: water balances and models for basins (under category 1); land application of waste waters (category 2); hydrologic cycle toxic/hazardous pollutant identification (category 3); reuse options for waters of impaired quality (category 4); and island-wide total water resources management plan (category 5). (Zielinski-IPA)
W81-00336

NEBRASKA WATER RESOURCES CENTER FIVE-YEAR WATER RESOURCES RESEARCH PROGRAM, 1982-1987,
Nebraska Water Resources Center, Lincoln.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124356, Price codes: A06 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October, 1980. 86 p, 13 Fig, 2 Tab, 26 Ref.

Descriptors: *Nebraska, *Research priorities, *Research and development, *Water resources development, *Planning, *Water management(Applied), *Water utilization, Water supply, Water quality, Groundwater, Groundwater availability, Optimum development plans, Crops, Precipitation(Atmospheric), Water distribution(Applied), Surface waters, Surface-groundwater relationships, Institutions, Water policy, Groundwater resources, *Five-year plans.

Nebraska ground and surface water systems were estimated to contain approximately two billion acre-feet of water, and its long-term average precipitation to be 86 million acre-feet. Despite abundant water resources, not all areas of the State have an adequate or useful water source. Nebraska State water problems have been identified under five categories: water quantity; water quality; distribution and redistribution; water use efficiency and productivity; and legal-institutional. Some State areas have limited groundwater and no access to lakes/streams. Nebraska's Section 208 Water Quality Management Plan lists eleven sources of State water quality problems, with sedimentation identified as the most important. Water distribution problems result from climatic variability and differential access to State water supplies. A greater research effort is needed to use species of crops which are more water efficient to enhance overall water use efficiency/productivity. While legal-institutional arrangements provide the framework for water resources utilization and management, Nebraska has no current statutory/constitutional basis for establishing groundwater ownership, and public management systems do not recognize the interrelationships between ground and surface water. Nineteen specific research topics were developed to address the identified priority Nebraska water resources problems. (Zielinski-IPA)
W81-00337

WATER RESOURCES RESEARCH SUPPORT PROGRAM 1979-1980,
Inland Waters Directorate, Ottawa (Ontario).
1980, English and French, 14p.

Descriptors: *Water resources, *Research, Sediments, Pollutants, Groundwaters, *Canada, *Universities, Hydrologic modelling, Hydraulics, *Water systems, Data collection, Technology, Snow, Ice.

The Department of the Environment, on the recommendation of the Water Resources Research Support Program Review Group, has agreed to provide a total of $250,000 for water-related environmental research during 1979-80 to the Canadian university research community. The Water Resources Research Support Program provides for innovative research relevant to departmental concerns and responsibilities for water resources research in the natural and social sciences with emphasis on water management issues. By fostering the interest of university researchers, it thereby utilizes their knowledge and expertise in solving water research problems and provides opportunities for their participation in socially relevant environmental research. Sixteen universities across Canada will share the $250,000 which will be used to support interdisciplinary research programs aimed at solving regional and national water research issues. The areas of study and the institutions involved are included. (WATDOC)
W81-00383

WATER RESOURCES RESEARCH - THE EARLY YEARS,
New Mexico State Univ., Las Cruces.
H. R. Stucky.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference, Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 7-19. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *New Mexico, *Research and development, *Water Resources Research Act, *Water resources development, *Water supply, Institutions, Conference, Legislation, Planning, Prior appropriation, Water rights, Surface water.

Water is required by all life and influences all factors of the environment. All segments of society must share in the proper use of water and the control of pollution. Partial solutions to water resources problems have been started but much multidisciplinary research is necessary. Archaeologists have found centuries-old evience of water management by the Indians in New Mexico. The principles of prior appropriation---public ownership of surface water with rights assigned by prior appropriation and beneficial use---were applied to groundwater in 1931 by New Mexico law. Senate Bill S-2, the Water Resources Research Act of 1964, was signed on July 17, 1964 and established Water Resources Research Centers in each of the 50 states and Puerto Rico. These institutes began adding to the research already conducted by the Agricultural and Engineering Experimental Stations and various government and private agencies. One year prior, in 1963, the New Mexico State University Water Research Institute was authorized and thus became the first state institute in the nation. The first 8 annual New Mexico Water Conferences, from 1956-1963, were the forerunners of the Institute. The Institute's statewide responsibilities, methods of research and objectives are reviewed. A discussion of the Institute's policies regarding funding, means of contact, working relationships, and agreements made with governments, scientists and supporting organizations is presented. (Atkins-Omniplan)
W81-00391

A HISTORICAL PERSPECTIVE OF WATER MANAGEMENT IN NEW MEXICO,
New Mexico Interstate Stream Commission, Santa Fe.
S. E. Reynolds.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 20-32. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *New Mexico, *Water law, *Water resources, *Water management(Applied), *Judicial decisions, Water utilization, Competing uses, Diversion, Preferences, Non-riparian waters, Beneficial uses, Prior appropriation, Riparian rights, Federal project policy.

The last 25 years of water management in New Mexico have been shaped by significant court decisions and interpretations of the statutes: the statues are based on the appropriation doctrine rather than the riparian doctrine of water rights. Surface water codes were codified in 1907 and affirmed in the state construction of 1911. Ground water codes were applied in 1931. Twenty six other states have been influenced in their approach to water management. Sixty state supreme court decisions in the last 25 years attest to the activity. The statutes and decisions have shaped public use as well as economic enterprise, based on the principles of beneficial use weighing considerations of equity and the time of use for rights. The state engineer's every decision, act or refusal to act is subject to appeal to district court. In New Mexico a water right is a property right. State versus Federal controversy over instream flows is clear in New Mexico: there can be no instream water right. (Meade-Omniplan)
W81-00392

MINE DEWATERING,
M. B. Campbell.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 175-180. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *Mine water, *Water treatment, *Legal aspects, *Mining, *Mine Dewatering Act, *New Mexico, Surface water, Uranium, Mining, Equitable apportionment, Water appropriation, Ion-exchange, Mineral industry, Water permits, Legislation.

A mine dewatering controversy exists in New Mexico which focuses on the uranium industry. The extraction or discharge of water encountered in mineral production is necessary in several mining operations. Federal and state water quality standards require mining companies to clean water prior to discharging it at the surface. The New Mexico Department of Energy estimates that by the mid-1980's New Mexico will have 72 active uranium mines each discharging water in quantities of approximately 90 cu/ft/sec. The uranium industry's cleaning process is accomplished with an ion-exchange which allows uranium particles to drop out of the water, thus determining the water to be of beneficial use. Since no permit of appropriation was granted, as required by the state for the beneficial-use water, significant legal effects exist. In 1980, the Mine Dewatering Act was passed which subject mine dewatering companies to the jurisdiction of the State Engineer. They will also be given the right to replace the water of other water owners whose activity is imparied. Providing a plan of implementation is approved, the Mine Dewatering Act of New Mexico provides flexibility, prevents companies from dewatering for the entire lifetime of the mine and maintains traditional doctrines of appropriation. (Vernale-Omniplan)
W81-00398

DISPUTES OVER WATER QUALITY POLICY: PROFESSIONAL CULTURES IN CONFLICT, 1900-1917,
Carnegie-Mellon Univ., Pittsburgh, PA.

For primary bibliographic entry see Field 5F.
W81-00407

SHOULD I ARBITRATE OR LITIGATE.
P. J. Sullivan.
Water and Sewage Works, Vol 127, No 10, p 37, 59, October, 1980.

Descriptors: *Contracts, *Claims(Contracts), *Municipal water, Specifications, Legal aspects, Sewerage, Performance, Supply contracts, Design, Construction, Judicial decisions, Legal review.

Some contract disputes may be resolved by the parties attempting to find solutions rather than faults, avoiding, wherever possible, the intervention of lawyers, while some can be avoided by drawing up contracts and working agreements that leave little room for argument. A contract usually specifies sewer size and bedding type and contains other statements to the effect that the contractor must follow the owners' specifications. Some municipalities wrongly attempt to force the contractor to accept responsibility for all eventualities while at the same time retaining complete control. Courts generally frown upon clauses stating that the owner has a right to take the job away from a contractor if the latter does not perform as specified under certain circumstances. The author recommends a letter of credit rather than a bond as a guarantee that the contractor will perform as required. If a dispute brings about a law suit, it is then the bank that is sued. An unconditional letter of credit implies that the bank must not involve itself in a dispute, though the bank is entitled to pay the money to the owner or to pay the money to the court if the bank is sued. (Gish-FRC)
W81-00444

SHIPPING IN THE BALTIC,
Handelshogskolan i Stockholm (Sweden).
G. Alexandersson.
Ambio, Vol 9, No 3-4, p 158-162, 1980. 5 Fig, 11 Ref.

Descriptors: *Ships, *International commissions, *Recreation wastes, *Water pollution control, Harbors, Transportation, Ferry boats, Water pollution sources, Marinas, Boating, Waste water treatment, Commercial fishing, Baltic Sea, Oceans.

The effects of changing trends in shipping on water pollution control in the Baltic Sea are discussed. Since 1950, ships have increased in size, speed, and in level of specialization, yet have decreased in number. The Great Belt, a Danish transit route, has become the primary passageway from the North Sea to the Baltic, because its depth can accommodate modern ships. All shipping services have become automated. Passenger transport has declined, while ferry traffic has increased in conjunction with road traffic. In the Soviet Union, Baltic ports are favored over Black Sea ports for general cargo trade, and, within the Scandinavian countries, the number of dominant ports is declining. These trends reduce the number and simplify the building of port installations needed to comply with international agreements on the control of water pollution. Increases in water-oriented recreation may provide popular support for costly water quality measures, yet may create new shipping problems and new demands for Baltic water pollution control facilities. (Titus-FRC)
W81-00448

WATER-RELATED ENVIRONMENTAL FACTORS,
Inland Waters Directorate, Edmonton (Alberta).
R. J. Lane.
In: Proceedings of the Technology Transfer Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 1, p, 9, 101-106, 1979.

Descriptors: *Environmental impact assessment, *Arctic, *Northern development, *Environmental effects, Planning, Water quality, Water pollution, Administration, Water supply, Flow, Rivers, Sediment transport, Canada.

Costly, accelerated response by government to northern developmental assessment is still evolving, but it is clear that IWD has responsibilities in the process to provide advice to an initiator's development of an initial environmental evaluation (IEE), to provide staff to serve on environmental assessment panels, to assist in the preparation of guidelines for invironmental impact statements (EIS), and to evaluate EIS reports. No IWD studies are needed except when paid for by an initiator or when IWD is incapable or providing sound advice. For water quantity, federal interests are interprovincial flows or international commitments, the latter including factors relating to waterfowl and climate. A change in flow trend because of development could also create an inventory concern. Concerns related to sister agencies in the north are flood demaged, changes in navigable waters and threatened waterfowl or fish habitat. Pertinent water quality concerns are in interprovincial or international waters. In addition, contaminantion by toxic substances requires problem definition, as well as parameter sampling and predictive model evaluation. Other quality concerns are radioactivity, eutrophication, oil spills and waste heat disposal. Additional network development for impact assessment should be minimal and preferably cost-shared with provincial or territorial governments. (WATDOC)
W81-00458

6G. Ecologic Impact Of Water Development

WATER RESOURCES OF THE RIO GRANDE AN INTERDISCIPLINARY APPROACH,
New Mexico State Univ., Las Cruces.
For primary bibliographic entry see Field 6A.
W81-00394

THE ARTIC ISLANDS PIPELINE PROJET: ITS GOALS, OBJECTIVES AND PROGRAM DEVELOPMENT FOR FRESHWATER PROJECT NO. 1,
Inland Waters Directorate, Winnipeg (Manitoba).
J. E. Slater.
In: Proceedings of the Technology Transfer Workshkop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 1, p 7-8, 97, 1979,

Descriptors: Geomorphology, Hydrologic properties, Keewatin district, Spence Bay, Canada.

The terms of reference supplied to the study group were to examine the effects of a buried gas pipeline on river crossings. Because of provincial jurisdiction, study was confined to regions north of 60 degrees latitude. The principal constraints on the study were time and money. The time period of 2-3 years made available was insufficient to obtain data for hydrologic and geomorphic parameters in the usual way which normally relies on statistical analysis for sampling periods in excess of 10 years. The absence of any hydrologic network north from the Keewatin district (one station on Cornwallis Island) made data transfer techniques untenable. However, it was possible to provide a qualitative description of river features based on map studies, airphoto analysis, and spot sampling of pertinent parameters at 27 selected river sites visited on two reconnaissance surveys, sampling information, later assembled in a stream catalogue, described streamflow, sediment concentration, bed and bank material, ground-ice conditions, floodplain characteristics, river slope and valley-wall approaches. Aside from their value the data assisted researchers in associated disciplines. Not very much hard data resulted from these stuidies, but examination of fluvio-morphologic processes active in the barrenland permafrost regions permitted the tentative definition of some areas thought to be environmentally sensitive to pipeline activity. (WATDOC)
W81-00457

7. RESOURCES DATA

7A. Network Design

MICROBIOLOGICAL WATER AND EFFLUENT SAMPLE PRESERVATION,
Canada Centre for Inland Waters, Burlington (Ontario).
B. J. Dukta, and A. El-Shaarawi.
Canadian Journal of Microbiology, Vol 26, No 8, p 921-929, August, 1980. 6 Tab, 8 Ref.

Descriptors: *Water sampling, *Water storage, *Water temperature, *Aquatic bacteria, *Bioassay, Coliforms, Streptococcus, Sewage bacteria, Analytical techniques, Membrane processes, Municipal wastes, Domestic wastes, Industrial wastes, Pulp wastes, Streams.

The effect of storage temperature on four water samples (relatively pure stream water, water containing municipal sewage, a canal containing industrial wastes including pulp and paper effluents, and the unchlorinated effluent from a sewage treatment plant) was studied to ascertain whether the period between sample collection and sample analysis could be extended without significantly affecting bacterial populations. Bacteria tested were total coliform (TC), fecal coliform (FC), fecal streptococcus (FS), and heterotrophic bacteria (HB). Each water sample was cooled immediately after collection to approximately 1.5 C by storage in crushed ice. After 2, 24, 30, and 48 hours, the sample was homogeneously mixed, and a subsample was tested. Analysis of variance was performed on the replicated data and on the entire data set. The results indicated that original water temperature does not seem to be a consistent factor in the preservation of microbiological water samples; over 75% of samples tested for TC, FC, and FS were microbiologically stable for at least 24 hr in melting-ice conditions. At least 42% of samples were stable for 48 hours. HB density was the least stable, with at least 30% and 50% of analyses being stable at 48 and for at least 24 hours, respectively. The results demonstrate that natural water samples to be tested for TC, FC, FS, and HB can be preserved for 24 hours without significantly changing microbiological characteristics. (Gish-FRC)
W81-00255

MORPHOMETRIC AND HYDRAULIC DATA COLLECTION PROGRAMS,
Water Survey of Canada, Ottawa (Ontario).
J. G. Way.
In: Proceedings of the Technology Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 1, p 13, 123-124, 1979.

Descriptors: *Environmental impact assessment, *Arctic, *Northern development, *Environmental effects, Data collections, Hydrologic properties, Hydraulic properties, Maps, Sampling, Photo analysis, Measurement, Arctic islands, Pipelines, On-site data collections, Canada.

This talk describes data assembly techniques used in the Arctic Island Pipeline Program. Site selection was by map and airphoto analysis, as was the assembly of data on chosen sites for stream order, hypsometric coefficients, integrals, basin area, river length, basin perimeter length and width. In the field, samples were obtained of suspended sediment, bed material, streamflow, water quality and thaw depth. Qualitative assessemtn of surrounding terrain was made on prepared forms. Hydraulic channel properties were measured. Subsequent analysis suggested possible flood magnitudes for studied sites. To incorporate these procedures into regular programs requires staff training. (WATDOC)
W81-00461

7B. Data Acquisition

DIRECT DETERMINATION OF LEAD IN POLLUTED SEA WATER BY CARBON-FURNACE ATOMIC ABSORPTION SPECTROMETRY,
Napier Coll. of Commerce and Technology, Edinburgh (Scotland). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W81-00253

SPECTROPHOTOMETRIC DETERMINATION OF TRACES OF COBALT IN WATER AFTER PRECONCENTRATION ON REAGENT-LOADED POLYURETHANE FOAMS,
Eotvos Lorand Univ., Budapest (Hungary). Inst. of Inorganic and Analytical Chemistry.
T. Braun, and M. N. Abbas.
Analytica Chimica Acta, Vol 119, No 1, p 113-119, September 1, 1980. 1 Fig, 5 Tab, 23 Ref.

Descriptors: *Water analysis, *Cobalt, *Trace elements, *Spectrophotometry, *Foam fractionation, Separation techniques, Analytical techniques, Filtration, Absorption, Testing.

A simple, inexpensive and rapid method for the preconcentration of traces of cobalt from large volumes of water on reagent-loaded polyurethane foam columns prior to spectrophotometric determination of the cobalt is described. Open-cell polyurethane foam loaded with 1-(2-pyridylazo)-2-naphthol (PAN) was used to concentrate cobalt from a parts per billion level in water with a concentration factor of 1000 or more. Cobalt was retained quantitatively from thiocyanate solution on the loaded foam placed in a column and recovered completely from the foam by elution with acetone. Spectrophotometric determination of cobalt was carried out with 4-(2-pyridylazo)-resorcinol at 510 nm after interfering ions were removed with a Dowex 1-X8 column. The results for the determination of 1.0 micrograms of cobalt in the presence of 10.0 micrograms of nickel and 20.0 micrograms of iron before and after the Dowex column separation indicated good recovery rates for cobalt with column separation. (Baker-FRC)
W81-00254

A SIMPLIFIED AUTOMATED CHELOMETRIC METHOD FOR THE DETERMINATION OF SULFATE IN INTERSTITIAL WATER AND SEAWATER,
Quebec Univ., Rimouski. Dept. of Oceanography.
J. Lebel, and N. Belzile.
Marine Chemistry, Vol 9, No 4, p 237-241, August, 1980. 1 Fig, 3 Tab, 7 Ref.

Descriptors: *Chelation, *Connate water, *Automation, *Sulfates, *Chemical precipitation, Sea water, Volumetric analysis, Electrodes, Analytical techniques, Chemical analysis.

A method is described whereby sulfate can be determined in interstitial water and in seawater. The method calls for the precipitation of barium sulfate. Excess barium is then titrated with ethylenediaminetetraacetic acid using an amalgated silver electrode for end-point detection. This determination is as accurate as the classical gravimetric method used and is valuable due to the simplicity and small sample requirements. The value of using small samples becomes particularly clear when analyzing interstitial water samples. An accuracy of better than 0.5% is obtained with this method. (Baker-FRC)
W81-00256

AN INSTRUMENTED LYSIMETER SYSTEM FOR MONITORING SALT AND WATER MOVEMENT,
Science and Education Administration. Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 2G.
W81-00273

A REMOTE MONITORING SYSTEM FOR WATER QUALITY PARAMETERS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
E. D. Hart, and B. W. McCleave.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 89-90, (1979) 3 Fig.

Descriptors: *Remote sensing, *Monitoring, *Waves(Water), Data processing, Data collecting, Computer programs, Algorithms, Equipment, Measurement, Parametric hydrology, *Water quality, Microprocessors, Electronic equipment, Data transmission.

A remote wave monitoring system has been developed to study wave action, a major contribution to streambank damage. The system uses a microprocessor with state-of-the-art low-power components. It functions unattended, uses less than 10 watts of power, and the batteries may be charged by solar cells. A Texas Instrument 733 cassette tape with a low-power Memodyne recorder is used to store 35 days worth of data. Data can be printed on any Silent 733 terminal or transmitted over telephone lines. Time of day is recorded for synchronization and comparison. The hardware utilizes two printed circuit boards, a commercially available board and a Waterways Experiment Station Input and Output board. There are several software utility packages to allow modular program development, Algorithms which fit the application are used for data processing. The best algorithm for wave height analysis is yet to be determined. At present the system is being laboratory tested. With debugging it will become a valuable tool that can be adapted to almost any water quality parameter. (See also W81-00290) (Seigler-IPA)
W81-00307

SURGE TANK WATER LEVEL VARIATIONS FOLLOWING RAPID VALVE OPENING,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Civil Engineering and Building Technology.
P. W. France.
Advances in Water Resources, Vol 3, No 1, p 41-43, March, 1980. 3 Fig, 8 Ref.

Descriptors: *Surge tanks, *Surges, *Mathematical models, *Water levels, Valves, Equations, Measurement, Instrumentation, Pipelines, Penstocks, Energy, Engineering structures, Flow, Water flow, Flow rates, Model studies, Hydraulic models.

Experimental values for maximum downsurge following rapid valve opening in a model surge tank were investigated over a range of flow rates employing a modified initial value technique. Movement of the water surface in the surge tank after valve opening may be calculated for any time after valve closure by an energy equation where the length and area of the supply tunnel and velocity through the tunnel are known. The basic equations may be reapproached in the finite difference form, where changes in tank levels may be determined. A desk top calculator linked to a graph plotter was programmed to give a visual display of the finite difference solutions. By applying a predictor-corrector technique, an average gradient over the time interval may be generated to yield closer approximation to the actual curve than the tangential straight lines obtained from the simple initial value method. Results indicated that, for this type of Perspex surge tank, a great deal of the water flowing in the penstock following rapid valve opening originates from the supply tunnel; this should therefore be considered in any calculations. (Geiger-FRC)
W81-00409

MASS FRAGMENTOGRAPHIC DETERMINATION OF POLYMETHYLNAPHTHALENE AND POLYMETHYLPHENANTHRENE IN A CRUDE OIL AND IN MARINE ORGANISMS,
Hyogo Prefecture Public Health Inst., Kobe (Japan).
K. Adachi.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 416-423, September, 1980. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Oil, *Oysters, *Mass fragmentography, Marine animals, Chromatography, Analytical techniques, Gas chromatography, Mass spectrometry, Water pollution effects, Oil pollution, Organic compounds, Separation techniques.

An activated charcoal chromatographic separation procedure for polymethylnaphthalene (PMN) and polymethylphenanthrene (PMP) in crude oil and a mass fragmentographic method for the quantitative determination of trace levels of these compounds in marine organisms are described. Tissue samples were homogenized and then saponified for 3 hr followed by filtration and extraction with n-hexane. Extracts were subjected to Florisil column cleanup and the eluate was concentrated before undergoing activated charcoal column chromatographic separation. Each eluate from the charcoal column was analyzed by gas chromatography-mass spectrometry. Biogenic compounds and ambiguous pollutants interferred with gas chromatographic analysis of marine organisms exposed to petroleum contamination at levels as low as a few micrograms/g. The single ion detection attachment was used during mass fragmentographic analyses for PMN and PMP. Ranges of PMN and PMP products in 0.5 mg of a crude oil and 50 g of oyster tissue were found to be 0.008-0.423 micrograms and 0.025-2.077 micrograms, respectively. Tests to study the applicability of the technique as an identifier of petroleum contamination were conducted on tissues of oysters collected from the Seto Naikai coast. Mass fragmentograms of oyster tissue were very similar to those of grade-A crude oil. The technique works well for assessment of long-term effects on marine organisms and environmental samples exposed to chronic low-level discharges of petroleum. (Geiger-FRC)
W81-00437

PRIORITY POLLUTANT ANALYSES OF INDUSTRIAL WASTEWATERS USING A MICROEXTRACTION APPROACH,
Southwest Research Inst., San Antonio, TX. Dept. of Environmental Sciences.
J. W. Rhoades, and C. P. Nulton.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 467-484, 1980. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Microextraction, *Pollutant identification, *Aromatic compounds, Gas chromatography, Organic wastes, Analytical techniques, Separation techniques, Water pollution sources, Chemical wastes, Plastics, Industrial wastes, Phenols, Waste water(Pollution), Laboratory tests.

A microextraction procedure for analyzing priority-pollutant volatile aromatics, phthalates, polynuclear aromatics, and phenols in waste water was tested on a variety of process waters and effluents from the plastics and organic chemistry industries by the EPA during verification analyses. The extraction was a one-step method in which the solvent: waste water ratio ranged from 1:40 to 1:100. Benzene, toluene, and ethylbenzene were extracted with pentane, and polynuclear aromatic hydrocarbons and phthalates were extracted with hexane. Waste water analyzed for phenols first underwent a base-neutral extraction using methylene chloride and diisopropyl ether. Gas chromatographic analysis was then performed. Comparisons of microextraction results with exhaustive extraction results showed that less variability in spike recoveries and in duplicate analyses occurred with the microextraction method. Data from the analysis for phenols indicated that exhaustive extraction did not necessarily lead to higher recoveries and that high extraction efficiencies (> 70%) were not essential for achieving reliable analyses. Single-step extraction allows the analyst to extract selectively the analyte of interest with relative ease. Microextraction also minimizes false positives, difficulties caused by emulsions, and the necessity for column cleanup. (Geiger-FRC)
W81-00445

EXPERIMENTAL APPLICATION OF GAS CHROMATOGRAPHIC HEADSPACE ANALYSIS TO PRIORITY POLLUTANTS,
Greenwood Lab., Kennett Square.

G. R. Umbreit, and R. L. Grob.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 429-466, 1980. 2 Fig, 1 Tab, 45 Ref, 1 Append.

Descriptors: *Gas chromatography, *Organic wastes, *Pollutant identification, Volatility, Water pollution sources, Aromatic compounds, Storage, Headspace gas analysis, Analytical techniques, Laboratory tests, Chlorides, Sealants, Separation techniques.

The analysis of headspace gases is useful in determining volatile organics present as pollutants in water in which the aqueous phase is equilibrated with an inert gas phase, usually of equal volume. The gas phase of the contaminant is extracted by a gas and subsequently analyzed by gas chromatography. The theories and procedures for headspace gas analysis are reviewed. Pre-experiment tests using three separate samples containing vinyl chloride, methyl chloride, and ethyl chloride showed that distilled water caused an unknown interference, so tap water was used for the remainder of the analyses. Storage studies on these three volatile organics gave evidence that stability was sufficient for = or > 3 days. Samples containing vinyl chloride, methyl chloride, or ethyl chloride were sealed with Hycar or Teflon septums and analyzed at various intervals over the course of 16 days. No differences were found between the performance of the two types of seals, and both were found to maintain stability of the samples under conditions and in the time periods used. The total range of variation increased with increasing storage times. The present method has been applied to the determination of benzene, toluene, xylenes, and chlorobenzene at levels < or = 10 micrograms/liter and carbon tetrachloride, 1,1,1-trichloroethane, chloroform, bromoform, dichlorobromomethane, dibromochloromethane, trichloroethylene, and tetrachloroethylene at < or = 1 microgram/liter. (Geiger-FRC)
W81-00446

ESTIMATED APPLICATION OF GAS CHROMATOGRAPHIC HEADSPACE ANALYSIS TO PRIORITY POLLUTANTS,
Catalytic, Inc., Philadelphia, PA. Environmental Systems Div.
W. F. Cowen, and R. K. Baynes.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 413-427, 1980. 4 Tab, 18 Ref.

Descriptors: *Gas chromatography, *Pollutant identification, *Water pollution sources, Organic wastes, Headspace gas analysis, Volatility, Aromatic compounds, Separation techniques, Laboratory tests, Analytical techniques.

The application of a gas chromatography headspace technique to the determination of EPA priority pollutants was examined. Preselected conditions for all estimates of headspace gas levels included a temperature of 25C, equal volumes of headspace gas and liquid phases, no significant ionic strength or salting out effects, a simple binary (pollutant-water) system, and an initial priority pollutant level of 5 micrograms/liter. Theoretical distribution coefficients were calculated from vapor pressure and aqueous solubility values found in the literature. Estimated headspace gas concentrations for 26 priority pollutants are compared to instrument detection limits obtained from flame ionization, electron capture detectors, and Hall electrolytic conductivity methods. Of the 33 purgeable priority pollutants estimated as amenable to headspace determination at an aqueous concentration of 5 micrograms/liter, only acrolein, acrylonitrile, 2-chloroethyl vinyl ether, and 1,3-dichloropropene remain questionable for this type of analysis. (Geiger-FRC)
W81-00447

APPROACH TO QUALITY ASSURANCE/QUALITY CONTROL IN THE ORGANIC CHEMICALS INDUSTRY MONITORING PROGRAM,
Environmental Protection Agency, Washington, DC. Effluent Guidelines Div.
P. W. Holtzclaw, and M. D. Neptune.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 525-543, 1980.

Descriptors: *Industrial wastes, *Quality control, *Water quality standards, *Organic wastes, Testing procedures, Water pollution, Water analysis, Clean Water Act, Water pollution control, Legislation, Analytical techniques, Monitoring, Toxins.

In 1977, the Clean Water Act called for the development of guidelines to control specific toxic pollutants in industrial discharges. New analytical procedures have been formulated to meet this mandate, and quality assurance (QA) and quality control (QC) programs have been devised to provide data on the precision and accuracy of the analytical results. QA procedures encompass the total program which ensures the consistency and reliability of results. QC procedures are collective routine actions taken to provide QA in the laboratory. A QA/QC plan was designed for the Organic Chemicals Branch which had placed upon it a 2-wk period for method refinement and a rapid turnaround of samples during a 3-day sampling episode to simulate heavy workload conditions. Spiking and recovery studies were repeatedly employed to overcome the problems of variability in waste waters. The program was composed heavily of QA measures, but the quality of the generated data was known by the end of the study. Changes in the objectives or use of the data would necessitate changes in QA formats. Other programs may not require such QA measures, so before a QA/QC plan is initiated, available resources and projected use of data to be generated should be carefully considered. (Geiger-FRC)
W81-00451

ANALYTICAL PROBLEM SOLVING WITH VERIFICATION SAMPLES INTERFERENCE REDUCTION OPTIONS,
PJB Laboratories/Jacobs Engineering, Pasadena, CA.
For primary bibliographic entry see Field 5A.
W81-00452

AN EVALUATION OF FACTORS AFFECTING THE MICROEXTRACTION OF BENZENE, TOLUENE, ETHYLBENZENE AND O-XYLENE INTO PENTANE,
Little (Arthur D.), Inc., Cambridge, MA.
K. E. Thrun, K. E. Simmons, and J. E. Oberholtzer.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 485-501, 1980. 6 Fig, 6 Tab, 2 Ref.

Descriptors: *Microextraction, *Solvent extractions, *Aromatic compounds, Evaluation, Volatility, Gas chromatography, Water pollution treatment, Analytical techniques, Pollutant identification, Water pollution sources, Separation techniques, Organic compounds, Laboratory tests.

Factors affecting the efficiency of a microextraction method to extract benzene, toluene, ethylbenzene, and o-xylene from water into pentane were examined. Quantitative analyses using microextractions are subject to loss of organic extracts through dissolution in the aqueous phase and volatilization. Also, since microextraction is usually done with a high sample:solvent ratio, compounds that do not partition readily into the organic phase will not be extracted as well. The present technique was designed to circumvent these problems. Two sample to solvent ratios (20:1 and 100:1) and various organic solvents were tested to see if comparable results could be obtained. The effects of salting out with sodium sulfate and the presence of other organics in the matrix were also studied. Samples were analyzed by gas chromatography with flame-ionization detection. Results of microextraction efficiencies were in good agreement with values estimated from published partition coefficients. Benzene was the least well extracted of the materials tested, though salting out with sodium sulfate significantly increased recoveries of this compound. Recoveries were generally lowered when the water-soluble organic acetonitrile was present, but this effect could be counteracted by saturation of the aqueous phase with sodium sulfate. Application of the microextraction technique to other priority pollutants seems to be limited by the partition coefficient. (Geiger-FRC)
W81-00453

CHARACTERISTICS OF GEL CHROMATOGRAPHY USING SEPHADEX GEL FOR FRACTIONATION OF SOLUBLE ORGANIC POLLUTANTS,
Yokohama National Univ. (Japan). Dept. of Safety and Environmental Engineering.
K. Urano, K. Katagiri, and K. Kawamoto.
Water Research, Vol 14, No 7, p 741-745, July, 1980. 9 Fig, 1 Tab, 8 Ref.

Descriptors: *Waste water treatment, *Chromatography, *Pollutant identification, Aromatic compounds, Spectrophotometry, Organic wastes, Gels, Analytical techniques, Separation techniques, Laboratory tests, Water pollution sources, Flow rates, Chemical properties.

Sephadex gel chromatography has recently become a feasible technique for the analysis of organic pollutants in waste water during treatment processes. Aqueous solutions kof 46 oranic compounds including organic polymers as well as low molecular weight compounds were chromatographed on Sephadex G-15 and G-25 columns. Eluted materials were measured by spectrophotometry for aromatic compounds and by total organic carbon analysis for non-aromatic compounds. The influence of water flow rate on the outcome of chromatograms and data reproducibility was studied on polyethyleneglycol (PEG)-1000, butyric acid, and phenol at flow rates of 0.2, 0.4, or 0.6 ml/min. Little difference (< 7%) was observed among peaks generated at different flow rates, so subsequent tests were run at a flow rate of 0.4 ml/min. Compounds having structures similar to PEG, sugars, and glycines displayed increased elution volumes as molecular weights decreased. However, this conventional relationship did not apply to many of the lower molecular weight compounds studied. In the case of aliphatic alcohols, aldehydes, carboxylic acids, sulfonic acids, ketones, and aromatic sulfonic acids, elution volumes increased with increasing molecular weights or carbon numbers. Results indicated that elution volume depended upon the chemical structure of the organic compound, because this determines the affinity of the molecule for Sephadex gel and water. (Geiger-FRC)
W81-00493

PARTICULAR SOLUTIONS TO THE PROBLEM OF HORIZONTAL FLOW OF WATER AND AIR THROUGH POROUS MEDIA NEAR A WETTING FRONT,
Cold Regions Research and Engineering Lab., Hanover, NH.
Y. Nakano.
Advances in Water Resources, Vol 3, No 2, p 81-85, June, 1980. 9 Ref.

Descriptors: *Unsaturated flow, *Fluid mechanics, *Air-water interfaces, *Mathematical studies, Thermodynamic behavior, Equations, Air circulation, Flow, Physics, Porous media, Darcys law.

Solutions are derived for the horizontal and simultaneous flow of water and air through homogeneous porous media near a wetting front. Two cases of the Cauchy problem of water movement are examined, the one-phase flow, in which movement of air is negligible or unrestricted, and the two-phase flow, where the effects of air flow on water flow are significant. Regularity properties are compared, and the effects of air flow on water flow are discussed. In one-phase flow problems, the wetting front, defined as the interface between dry and partially saturated parts of media, becomes an acceleration wave. The two-phase flow problem indicates that an interaction between water and air occurs near the wetting front. Singularity occurs in the solutions at the wetting front in both one- and two-phase problems. However, the one-phase flow solution only approximates the two-phase flow solution when saturation is minimal. The solutions support observations on various related initial

value problems which suggest that the system is in the intermediate asymptotic state and far from thermodynamic equilibrium. (Titus-FRC)
W81-00496

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR MAINE, WATER YEAR 1979,
Geological Survey, Augusta, Maine, Water Resources Division.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120925, Price codes: A11 in paper copy, A01 in microfiche. Geological Survey Water-Data Report ME-79-1, August 1980. 228 p, 3 Fig.

Descriptors: *Maine, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for Maine consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 69 gaging stations, stage only for 2 gaging stations, contents for 17 lakes and reservoirs, water quality for 13 gaging stations and 27 wells, and water levels for 21 observation wells. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies. (USGS)
W81-00343

WATER RESOURCES DATA FOR GEORGIA, WATER YEAR 1979,
Geological Survey, Doraville, GA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120933, Price codes: A22 in paper copy, A01 in microfiche. Geological Survey Water-Data Report GA-79-1, July 1980. 501 p, 9 Fig.

Descriptors: *Georgia, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for Georgia consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 100 gaging stations; stage for 10 gaging stations; stage and contents for 17 lakes and reservoirs; water quality for 25 continuous stations, 151 periodic stations and miscellaneous sites; peak stage and discharge only for 98 crest-stage partial-record stations and 12 miscellaneous sites; measurements of discharge at 110 low-flow partial-record stations and 21 miscellaneous sites; and water levels of 28 observation wells. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Georgia. (USGS)
W81-00344

WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1979--VOLUME 1. ATLANTIC SLOPE BASINS, HUDSON RIVER TO CAPE MAY,
Geological Survey, Trenton, NJ. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119802, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NJ-79-1, July 1980. 347 p, 6 Fig, 3 Tab, 36 Ref.

Descriptors: *New Jersey, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Atlantic Slope basins(NJ).

Water resources data for the 1979 water year for New Jersey consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This volume of the report contains discharge records for 75 gaging stations, tide summaries for 1 station; stage and contents for 15 lakes and reservoirs, water quality for 111 surface water sites and 110 wells, and water levels for 35 observation wells. Also included are data for 44 crest-stage partial-record stations and 47 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in New Jersey. (USGS)
W81-00347

WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1979--VOLUME 2. DELAWARE RIVER BASIN AND TRIBUTARIES TO DELAWARE BAY,
Geological Survey, Trenton, NJ. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119810, Price codes: A11 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NJ-79-2, July 1980. 231 p, 6 Fig, 3 Tab, 36 Ref.

Descriptors: *New Jersey, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Delaware River basin(NJ), Delaware Bay tributaries(NJ).

Water resources data for the 1979 water year for New Jersey consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This volume of the report contains discharge records for 27 gaging stations, tide summaries for 3 stations, stage and contents for 16 lakes and reservoirs, water quality for 86 surface water sites and 65 wells, and water levels for 16 observation wells. Also included are data for 27 crest-stage partial-record stations and 25 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by U.S. Geological Survey and cooperating State and Federal agencies in New Jersey. (USGS)
W81-00348

UNITED STATES GEOLOGICAL SURVEY YEARBOOK, FISCAL YEAR 1979.
Geological Survey, Reston, VA.
1980. 169 p.

Descriptors: *Reviews, *Annual, *Projects, *Data collections, *Natural resources, Water resources, Water quality, Energy, Mapping, Geological surveys, Landslides, Mineralogy, Land management, Indian reservations, Coals, Oil industry, Programs, Administration, Cost allocation, Budgeting, U.S. Geological Survey.

The fiscal year 1979 Yearbook summarizes the activities of the U.S Geological Survey in response to its scientific and regulatory missions and its responsibility for exploration of the National Petroleum Reserve in Alaska. The main sections of this Yearbook are: (1) The Year in Review--a brief overview of the significant events of the Geological Survey during fiscal year 1979; (2) Perspectives--essays focusing on specific events (rather than scientific topics) and programs involving multi-Division participation; (3) Missions, Organization, and Budget--a description of the Geological Survey's major duties and assignments and of the organizational structure that supports its missions; (4) Division Chapters--a description of the significant accomplishments (rather than a comprehensive program by program discussion) of each of the mine operating Divisions and offices; and (5) Appendices--provide supplementary information regarding key personnel, cooperators, and selected summary budgetary tables and an index. (USGS)
W81-00352

HYDROLOGIC AND LAND-COVER FEATURES OF THE CALOOSAHATCHEE RIVER BASIN, LAKE OKEECHOBEE TO FRANKLIN LOCK, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. H. LaRose, and B. F. McPherson.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, paper copy $3.50, microfiche $0.50. Geological Survey Open-File Report 80-732 (WRI), 1980. 1 Sheet, 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Maps, *River basins, *Freshwater, *Surface waters, *Florida, Streamflow, Canals, Land use, Agriculture, Water quality, *Caloosahatchie River(Fl).

The freshwater part of the Caloosahatchee River basin, Fla., from Franklin Lock to Lake Okeechobee, is shown at a scale of 1 inch equals 1 mile on an aerial photomosaic, dated January 1979. The basin is divided into 16 subbasins, and the land cover and land use in each subbasin are given. The basin is predominantly rangeland and agricultural land. Surface-water flow in the basin is largely controlled. Some selected data on water quality are given. (USGS)
W81-00353

HYDROLOGIC DATA FROM UPPER GRANGE HALL CREEK BASIN, NORTHGLENN, ADAMS COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
D. C. Hall, and A. C. Duncan.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, Co. 80225. Paper copy $17.75, microfiche $3.50. Geological Survey Open-File Report 80-578, 1980. 132 p, 2 Fig, 34 Tab, 10 Ref

Descriptors: *Hydrologic data, *Streamflow, *Surface runoff, *Watersheds(Basins), *Colorado, Groundwater resources, Rainfall, Snowmelt, Sediment transport, Water quality, Water analysis, Data collections, *Northglenn(CO), *Adams County(CO), *Grange Hall Creek(CO), *South Platte River basin(CO)

Hydrologic data collected during 1977-79 as part of a water-resources investigation of storm runoff in Upper Grange Hall Creek basin, Adams County, Colo., are presented in this report. Data presented in tabular form consist of: (1) Estimated daily precipitation at one site (April through October, 1978 and 1979); (2) mean daily streamflow at two sites (December 1977 through September 1979); (3) instantaneous streamflow at two sites along Grange Hall Creek and corresponding cumulative rainfall at one to three sites for 17 storms (April 1, 1978, to August 26, 1979); (4) concentrations of selected major ions, fecal-coliform bacteria, suspended sediment, nutrients, and trace elements at five sites during dry-weather flow, at three sites during rainfall runoff, and at five sites during snowmelt runoff; and (5) concentrations of pesticides and polychlorinated biphenyls at two sites during dry-weather flow and rainfall runoff. (USGS)
W81-00366

ECOLOGICAL IMPACT ASSESSMENT,
J. M. Baker.
Marine Environmental Research, Vol 3, No 4, p

245-248, September, 1980. 1 Fig, 3 Ref.

Descriptors: *Industries, *Ecology, *Data collections, *Effluents, On-site data collections, Toxicity, Water pollution, Chemical analysis, Path of pollutants, Sampling, Biology, Adaptation, Water pollution control, Pollutants.

Approaches to ecological impact assessment of industrial developments may be viewed as continuing processes, rather than as complete sets of predictions. One known method of evaluating the impact of industrial development takes into consideration everything in the system, while another consists of data gathering toward an end product which is little more than a literature search. The present approach differs from these two schemes in that ecological impact predictions are treated as hypotheses that must be tested by experimental techniques, and industrial development itself is regarded as a large field test, the outcome of which is not yet known. Monitoring for existing sites is essential in assessing ecological impact. Examples of objectives and monitoring approaches in this system are comparison of effluents with statutory chemical specifications (chemical analyses), information on toxicity of effluents at discharge point or water in receiving area (lethality tests), detection of changes in species combination and abundance (ecological surveys), and information on the movement, fate, and uptake by organisms of pollutants (chemical analyses of water, sediment, and tissue). Quantitative biological sampling from sites of chronic discharge has proven fruitful. Field experiments are an alternate method that has been of great use in the monitoring of oil spills. (Geiger-FRC)
W81-00416

8. ENGINEERING WORKS

8A. Structures

TENNESSEE-TOMBIGBEE WATERWAY: PLANNING HISTORY,
Army Engineer District, Mobile, AL.
F. L. Currie.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 1-3, (1979).

Descriptors: *Tennessee-Tombigbee Waterway, *Tennessee River, *Tombigbee River, *Inland waterways, Canals, Canal design, Civil engineering, Locks, Navigation, Transportation, History, Project planning, Alabama.

An efficient waterway connecting the north-flowing Tennessee River with the south-flowing Tombigbee River to provide a continuous waterway from the Tennessee, Upper Mississippi, and Ohio Valleys to Mobile on the Gulf of Mexico is finally becoming a reality many years after it was first envisioned in the early 1700's. In 1819 Alabama had the project surveyed and in 1826 a company was chartered for the canal construction. The arrival of the railroad and right-of-way difficulties with the Cherokee Indians halted this attempt. In 1875 Congress authorized a survey of the project and a route was selected however, the report concluded that the route would only be usable during flood seasons. Following improvements on both rivers, another route was proposed by the Corps of Engineers in the early 1900's that would be usable year round but, due to excavation requirements this plan was also abandoned. In the 1930's the waterway idea once again was considered. In 1946 Congress authorized the Tennessee-Tombigbee Waterway but no funding was provided. The waterway was reevaluated in 1957 and in 1965. Finally in 1971 funds were appropriated for construction. (See also W81-00290) (Seigler-IPA)
W81-00291

TENNESSEE-TOMBIGBEE WATERWAY PROJECT DESIGN AND CONSTRUCTION ACTIVITY,
Army Engineer District, Mobile, AL.
F. G. Thompson.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 5-7 (1979) 3 Fig.

Descriptors: *Tennessee-Tombigbee Waterway, *Inland waterways, *Tennessee River, *Tombigbee River, Project planning, Canals, Canal design, Civil engineering, Locks, Navigation, Transportation, Environmental effects, Dredging, Locks, Engineering structures.

After a long period of planning, design, and construction, the Tennessee-Tombigbee Waterway is now scheduled to open for navigation in mid-1984. The Waterway will provide a shortened route between shipping points in mid-America and the deepwater ports of the Gulf coast. It will connect the Tennessee River at Pickwick Lake with the Tombigbee River at Demopolis, a water level difference of 341 feet. The Waterway has three sections; the 148 mile River Section, the 44 mile Canal Section, and the 40 mile Divide Section. Major structures on the River Section include the Demopolis Lock and Dam, the Gainesville Lock and Dam, the Aliceville Lock and Dam, the Columbus Lock and Dam, and the Aberdeen Lock and Dam. For the Canal Section a channel will be excavated east of the Tombigbee River leaving the river in an essentially natural state. The Canal Section will have five locks for a total lift of 140 feet. The Divide Section cut will require the excavation of 149,700,000 cubic yards of material at a cost of $270,601,206. The Corp of Engineers is placing much emphasis on environmental considerations and inspections are being conducted annually. Actual construction is now about 35% complete. (See also W81-00290) (Seigler-IPA)
W81-00292

TENNESSEE-TOMBIGBEE WATERWAY: PROJECT OPERATION, CULTURAL AND RECREATION RESOURCES DEVELOPMENT,
Army Engineer District, Mobile, AL.
G. L. Melton, J. J. Nielsen, and E. Topper.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 9-13 (1979) 5 Fig.

Descriptors: *Tennessee-Tombigbee Waterwsay, *Recreation facilities, *Archaeology, *Operation and maintenance, Canals, Project planning, History, Environmental effects, Inland waterways, Camping, Boating, Swimming, Lakes, Locks.

The cultural resources program for the Tennessee-Tombigbee Waterway is one of the most comprehensive programs of its type. Due to the number and variety of sites found the Tombigbee River Multi-Resource District was approved by the National Register in 1977. Human occupation of the area potentially dates back 12,000 years. It is estimated that sites, both prehistoric and historic, along the waterway probably number into the thousands. Redesign and avoidance procedures will be used to preserve as many sites as possible. Forty-nine recreation sites are planned for the 42,000 water surface acres of the project. Lakes associated with the project will have company areas, day use areas, and boat launching facilities. Two marinas will also be part of the initial recreational development. The initial recreation facilities will be operated and maintained by the Corps of Engineers. The area management office will be in Columbus, Mississippi, with three sub-offices located along the waterway. Due to limited Corps personnel operation and maintenance will be contracted to private enterprise. Descriptions and maps of individual lakes and recreation facilities are provided. (See also W81-00290) (Seigler-IPA)
W81-00293

MISSISSIPPI DAM SAFETY PROGRAM,
Mississippi Dept. of Natural Resources Jackson. Bureau of Land and Water Resources.
J. W. Pepper.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 23-25 (1979).

Descriptors: *Mississippi, *Dam failure, *Flood damage, Dams, Dam design, Dam construction, Flood control, Overflow, Spillways, Maximum probable flood, Safety, Safety factors, Inspection, Aerial photography.

In recent years Mississippi has passed laws to locate and remove hazards caused by dams and to require written authorization for future dams with drainage areas of fifty or more acres. There are as many as 125,000 livestock ponds in the State that were built prior to controls. Following the failure of dams such as the Teton Dam in Idaho in 1976 and the Toccoa Falls Dam in Georgia, $15 million was made available for dam inspection. In 1975 high altitude photographs were used to make an inventory of dams capable of storing 50 acre feet or more of water. Dams located where, if they failed, 'more than a few' lives would be endangered were placed in Category I. Seventy dams received this classification although later deletions and additions were made. Upon inspection, dams were considered unsafe if their spillway would not pass 50% of the Probable Maximum Flood without overtopping the dam. The major problems found were inadequate spillways and some dams designed by bulldozer operators had structural problems. Seepage and stability problems were also common. Cooperation from dam owners in making their dams safer was excellent. All unsafe dams have had some work to remedy their problems and much has been done to correct the lack of maintenance. (See also W81-00290) (Seigler-IPA)
W81-00296

PROCESS AND APPARATUS FOR MAINTAINING A DESIRED DEPTH OF A WATERWAY,
C. B. Pekor.
U.S. Patent No 4,189,253, 6 p, 10 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 949, February 19, 1980.

Descriptors: *Patents, *Sedimentation, *Channels, Sediment transport, Suspension, Flow control, Channel improvement, Pumps, Jets, Equipment, Channel morphology, Depth, Channel maintenance, Waterways.

A process and apparatus maintains a waterway at a desired depth, the bottom of which is subject to accumulation of sediment such as sand. The process comprises the placement of jet pumps on a vertically movable support together with the step of fluidizing the sediment immediately beneath the pumps so that they sink by gravity at least to the desired depth of the waterway. The process further comprises supplying injection water to the sediment covered pumps and removing the sediment-water slurry from the pump. A support member spans the width of the waterway being mounted for vertical movement relative to the bottom of the waterway. Jet pumps are mounted on the support member so that the entire array may be lowered at least to the desired depth of the waterway. Additionally, the structure on which the pumps are mounted may carry a conduit to which water under pressure is directed to fluidize the bottom, permitting the pumps to be lowered or raised. (Sinha-OEIS)
W81-00375

RANDOM HYDRODYNAMIC FORCE ON DAM FROM EARTHQUAKES,
Delaware Univ., Newark. Dept. of Civil Engineering.
C. Y. Yang, and V. Chiarito.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124166, Price codes: A02 in paper copy, A01 in microfiche. Technical Research Report (1980), 22p, 4 Fig, 5 Tab, 13 Ref. OWRT-A-047-DEL(2), 14-34-0001-0108.

Descriptors: *Dams, *Earthquakes, Hydrodynamics, Forces, Random process, *Dam design, *Gravity dams, Hydraulic structures, Model studies.

A new solution for the hydrodynamic force on gravity dams during earthquakes has been obtained. The horizontal acceleration of earthquakes is modelled by a time-dependent random process and the force response solution is given in terms of non-stationary power spectral density and the mean square function.

Field 8—ENGINEERING WORKS

Group 8A—Structures

W81-00378

SEISMIC RISK ANALYSIS OF WILMINGTON, DELAWARE,
Delaware Univ., Newark. Dept. of Civil Engineering.
C. Y. Yang, and P. Dressel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124166, Price codes: A03 in paper copy, A01 in microfiche. Technical Research Report (1980), 34p, 11 Fig, 4 Tab, 13 Ref. OWRT-A-047-DEL(1), 14-34-0001-0108.

Descriptors: Seismic risk, *Dams, Strengthening dams, Safety analysis, *Earthquakes, *Seismic studies, *Structural engineering, Vibrations, *Concrete dams, Delaware, Wilmington area(DE).

A seismic risk analysis is carried out for Wilmington, Delaware where an old and deteriorating concrete dam is located. The result confirms the prediction by the U.S. Geological Survey showing a risk of about 10% in 50 years for the occurrance of an earthquake ground acceleration of 0.04g. Extensions of predictions provide information for safety planning and strengthening of this dam.
W81-00379

UNDERGROUND RESERVOIRS CAN CONTROL STORMWATER OVERFLOWS,
Randolph and Associates, Inc., Peoria, IL.
For primary bibliographic entry see Field 5F.
W81-00417

WE INSTALL OUR OWN WATER MAINS,
Valparaiso Dept. of Waterworks, IN.
P. A. Coote.
American City and County, Vol 95, No 7, p 61-63, July, 1980. 2 Fig.

Descriptors: *Conduits, *Costs, *Contracts, Construction equipment, Economic planning, Municipal water, Water management(Applied), Administration, Installation costs, Construction costs, Legal aspects, Contract administration.

Details of the contract which Valparaiso's Department of Waterworks draws up with contractors for the installation of water mains are discussed. Added onto labor costs are the rental costs of excavators, other rental equipment, pressure testing, administrative costs, and 10% profit for the department. A typical job with a footage of 1,210 ft requires 106 hr and has an estimated cost of $3.70/ft. Actual costs has been $2.60/ft. Factors that led to the decision for the Department to do their own construction included departmental control over the pipe and fitting installation, the fact that crews had a thorough knowledge of the system, and the ability to maintain qualified personnel on the job. (McKeon-FRC)
W81-00433

8B. Hydraulics

INVESTIGATION OF A SURFACE RESISTIVITY TECHNIQUE FOR THE ESTIMATION OF HYDRAULIC CONDUCTIVITY IN STRATIFIED DRIFT AQUIFERS,
Connecticut Univ., Storrs. Dept. of Geology and Geophysics.
D. Scott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120594, Price codes: A06 in paper copy, A01 in microfiche. M.S. Thesis, 1980. 98 p, 17 Fig, 1 Tab, 73 Ref. OWRT-A-077-CONN(s), 14-34-0001-7014.

Descriptors: Surface resistivity technique, *New England, *Hydraulic conductivity, *Aquifers, Stratigraphy, Sands, Gravels, Water wells, Test wells, Model studies, Least squares method, Groundwater movement.

A least squares regression line correlating hydraulic conductivity with apparent formation factor of aquifers in sand and gravel (generally thought to be stratified drift in the cases discussed) is presented. Nineteen aquifers in southern New England were studied. Schlumberger vertical electrical soundings (VES) were conducted at water well sites for which pump test data were available. VES curves were automatically inverted and a value of aquifer resistivity was determined from the total longitudinal conductance of the resulting earth model. Methods for the interpretation of pump test data from water table and leaky artesian aquifers are discussed. The ratio of vertical to horizontal hydraulic conductivity averaged one to twenty-seven in the aquifers studied.
W81-00267

PROCEEDINGS, 14TH ANNUAL MISSISSIPPI WATER RESOURCES CONFERENCE, 24-25 SEPTEMBER 1979,
For primary bibliographic entry see Field 2E.
W81-00290

REAERATION TESTS, ENID LAKE OUTLET WORKS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
C. H. Tate.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 91-95, (1979) 3 Fig, 1 Append.

Descriptors: *Oxygenation, *Water properties, *Aeration, *Radioactive tracers, Spillways, Liquid scintillation counters, Gases, Mississippi, Reservoirs, Water quality, Water chemistry, Chemical analysis, Sampling, Water analysis, Mississippi, *Enid Lake(MS).

The radioactive gas tracer technique developed by Dr. E. C. Tsivoglou was used to measure the gas transfer characteristics at the outlet structure of Enid Lake on the Yocona River in northern Mississippi. The lake has an earth fill dam 8,400 ft long and 293 ft high. Two eleven ft-diameter concrete conduits pass water through the base of the dam to the concrete paved spillway. For testing the stream was dosed upstream with three tracing elements. Krypton-85, a radioactive tracer, measures gas transfer between the water and the atmosphere. Tritium, also rdioactive, was used to measure the dispersion of the dose in the water. Rhodamine-wt dye indicated the presence of the radioactive trcers at the sampling stations. Samples were analyzed for radioactive concentrations using a liquid scintillation counter. The four sampling stations used were located at the emergency gate slot, the outlet portal, the entrance to the tailwater, and over the sill. Due to equipment problems only six of the planned eight doses were released. Results from the six released show that tracer samples can be collected at hydraulic structures and small changes in gas transfer can be detected. Data summaries are presented in an appendix. (See also W81-00290) (Seigler-IPA)
W81-00308

CHANNEL AND DYNAMIC FLOW CHARACTERISTICS OF THE CHATTAHOOCHEE RIVER, BUFORD DAM TO GEORGIA HIGHWAY 141,
Geological Survey, Doraville, GA. Water Resources Div.
R. E. Faye, and R. N. Cherry.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.25. Geological Survey Water-Supply Paper 2063, 1980. 66 p, 22 Fig, 13 Tab, 11 Ref.

Descriptors: *Open channel flow, *Unsteady flow, *Flow characteristics, *Georgia, *Model studies, Mathematical models, Numerical analysis, Stage-discharge relations, Streamflow, Discharge(Water), Hydraulics, Mannings equation, Roughness(Hydraulic), Equations, Digital computers, Energy gradient, Cross-section, Hysteresis, *Chattahoochee River(GA).

Detailed flow and cross-section data for a 17-mile reach of the Chattahoochee River in northeast Georgia are described and summarized. Flow data include measurements of highly dynamic stage and discharge at five stations during the period March 21-23, 1976. Flow data were collected at 5-minute intervals and are listed accordingly. Coordinate data for 39 cross sections in the study reach are also listed. A mathematical model is developed and applied whereby stage data collected at a single station can be used to compute highly dynamic discharge at the station. The model is based on the continuity and momentum equations that described unsteady, one-dimensional flow in open channels. Both equations are transformed to a single quadratic equation which describes mean flow velocity at a single station. Flow-geometry parameters used by the model are computed using cross-section coordinates and the equation which describes the area of an irregular polyon. Use of the model in conjunction with highly dynamic stage data collected on March 23, 1976, provided close agreement between measured and computed discharges. The model was also used to investigate the sensitivity of highly dynamic discharge to channel and flow parameters. Computed dicharge was mot sensitive to changes in channel roughness and slope. (USGS)
W81-00362

SURGE TANK WATER LEVEL VARIATIONS FOLLOWING RAPID VALVE OPENING,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Civil Engineering and Building Technology.
For primary bibliographic entry see Field 7B.
W81-00409

ASPECTS OF RIVER MORPHOLOGY,
Inland Waters Directorate, Winnipeg (Manitoba).
R. W. Newbury.
In: Proceedings of the Technology Transfer Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters p, 12, 1979. Directorate, Ottawa, Ontario, Canada, Technical Workshop Seris No.

Descriptors: *Rivers, *Channel morphology, *Environmental effects, *Manitoba, Churchill River, Nelson River, Southern Indian Lake, Water levels, River flow, River systems, Drainage, Watershed management, Canada.

Central to the writer's view of river morphology is a concept of fitness - a concept most difficult to describe since it cannot be defined precisely, but is still based in science. Fitness in natural system describes how one system fits with others, how well it blends into a unified whole. Environmental impacts are deviations from this natural fit. Development of drainage networks, which are analogous to other natural network such as those of trees and blood vessels. The ratios of branch order and branch length remain constant regardless of basin size. A second concept of fitness examines the vertical distribution in a river system and addresses a concept of stream power. It states that equal segments of river channel in unconsolidated materials generate equal amount s of power. IN typical, upwardly concave profiles, the headwater segments have greater head but less water than lower segments. Natural river systems will work towards the re-establishment of this equilibrium when man introduces changes in the regime. Two examples of misfit systems in Northern Manitobs are the diversion of Churchill River into a headwater on the Nelson River, and the raising of southern Indian Lake water levels. In a geologic time-frame, these perturbations are of no consequence, but in the short run of 50 to 100 years, a normal planning horizon for larger-scale development, they creat rather severe environmenment impact. (WATDOC)
W81-00460

8I. Fisheries Engineering

NIGHTLY AERATION TO INCREASE PRODUCTION OF CHANNEL CATFISH,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
W. D. Hollerman, and C. E. Boyd.
Transactions of the American Fisheries Society,

Vol 109, p 446-452, 1980. 5 Fig, 5 Tab, 16 Ref. OWRT B-076-ALA(6), 14-34-0001-9101.

Descriptors: *Channel catfish, *Aeration, Dissolved oxygen, *Fish management, Ponds, Fish behavior, Unaerated ponds, Aerated ponds, Fish, Growth rates.

Channel catfish (Ictalurus punctatus) were stocked in 0.02- and 0.04-hectare ponds at 20,385 fish per hectare and fed daily. Fish averaged 11 cm total length and 6.2 g at stocking. Six ponds received nightly aeration (2 to 6 hours) and six ponds received no aeration. A maximum feeding rate of 90 kg/hectare was reached in October. In aerated ponds, no dissolved oxygen (DO) problems occurred, and survival was 92%. Fish mortalities resulted from DO depletion in all unaerated ponds, and survival was 40%. Nitrite-nitrogen concentrations were significantly higher in the aerated ponds, though never at levels reported as lethal to channel catfish. Concentrations of un-ionized ammonia were high enough in both aerated and unaerated ponds to have adversely affected growth. Aerated ponds yielded an average of 5,307 kg/hectare of channel catfish and had a net economic gain of $1,500 per hectare. The unaerated ponds yielded an average of 1,400 kg/hectare and were an obvious economic failure. Direct extrapolation of economic data to large commercial ponds is not advised.
W81-00268

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

WATER RESOURCES IN NORTH CAROLINA,
North Carolina Water Resources Research Inst., Raleigh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127318, Price codes: A04 in paper copy, A01 in microfiche. Annual Report, No UNC-WRRI-80-00, 1980. 68 p, 31 Fig. OWRT-A-999-NC(53).

Descriptors: *North Carolina, *Research priorities, *Chowan River, Eutrophication, Grants, Planning, Water resources, Water conservation, Agriculture, Research and Development, Information exchange, Projects, Reservoirs, Pulpmills, Waste water treatment.

The Institute supported 35 research projects during the year covering topics such as algal blooms on the Chowan River, the effects of large-scale agricultural development, the quality of the planned B. Everett Jordan Reservoir, water conservation, and wetlands protection. The nuisance blooms on the Chowan are one of the State's most serious and baffling environmental problems. The Chowan has too many nutrients from many sources. The Institute identifies needs, motivates and supports research, and promotes technology transfer. Water resources planning is another major concern of the Institute. New projects recently begun include: the hydrologic impacts of peat mining, treatment of pulp mill waste water, hydrologic and water quality models for in stream flow needs, and paper mill discharge effects on the Neuse. Institute 'mini-grants' funded last year included: appropriation technology and rural water and sanitation needs in the developing countries, groundwater quality at Greensboro's White Street landfill, and the potential for aquiculture in North Carolina. A listing of Institute reports and authors is included. (Seigler-IPA)
W81-00325

9D. Grants, Contracts, and Research Act Allotments

WATER RESOURCES RESEARCH PLAN FOR OREGON FOR THE PERIOD 1982-1987,
Oregon State Univ., Corvallis. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-122103, Price codes: A06 in paper copy, A01 in microfiche. Report prepared for Office of Water Research and Technology, October 31, 1980. 112 p, 12 Fig, 2 Tab, 21 Ref.

Descriptors: *Oregon, *Research priorities, *Irrigation water, Water allocation(Policy), Water law, Runoff, Water shortages, Water reuse, Budgeting, Planning, Estuaries, Columbia River, Forests, Watersheds(Basins), Consumptive use, *Five-year plans.

Oregon's major water-related problems involve seasonal, geographic, and year-to-year maldistribution between water supply and competing water uses with recurring water shortage and excessive runoff. The State's largest consumptive use will always be for irrigation but other problem areas include river water quality; lake and reservoir water quality; bays, estuaries, and wetlands; planning and management of water resources; and forested watershed management. Four major categories will be used to classify these problems for research purposes: (1) water use, (2) groundwater, (3) bays, estuaries, and wetlands, and (4) general. Under water use, priority research areas will cover water rights transfers; Columbia River water use; agricultural, municipal, and industrial reuse; and water pricing policies. General problems research will be used to evaluate irrigation systems and application methods and to analyze recent changes in Oregon's water laws and institutions. A listing of problem areas and related studies by Federal and State agencies include priority, agencies participating, scheduling, and funding. Budget information is given by research problem for the years between 1982 and 1987 on two schemes, a $115,000 annual funding and a $135,000 annual funding from the Office of Water Research and Technology. (Seigler-IPA)
W81-00284

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT GOALS AND OBJECTIVES,
South Dakota State University, Brookings. Water Resources Inst.
J. L. Wiersma.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-122061, Price codes: A05 in paper copy, A01 in microfiche. October, 1980. 94 p, 11 Fig, 8 Tab, 26 Ref.

Descriptors: *Research priorities, *South Dakota, *Research and development, *Precipitation(Atmospheric), *Agriculture, *Water resources development, Planning, Project planning, State jurisdiction, Erosion, Runoff, Rainfall intensity, Rain, Dams, Water conservation, Water use, Water quality, Wetlands, State governments, Water rights, Interstate rivers, Missouri River, *Five-year plans.

The five-year program was developed from a review of South Dakota water resources activities and issues. Water problems were concluded to revolve basically about a nonuniform and deficient annual precipitation, capable of producing storms of unusual intensity, for this principally agricultural State. Agriculture controls the basic research needs, requiring dependence on a judicious use and conservation of water resources. Potential water use exceeds that received by precipitation. Runoff-erosion processes that transport contaminants to surface water represent an additional concern. Since a documented State water plan has been lacking, the development of a base by researchers for proper decision-making was deemed important. The principal problems requiring research and resolution relate to sporatic and insufficient rainfall; transportation needs for available fresh water in Missouri River dams; and water use rights. The five-year plan has detailed proposed activities related to seven State water problem categories: (1) water quantity management; (2) conservation and efficient use; (3) water quality; (4) legal/institution/social/economic problems; (5) supply; (6) water-energy relationships; and (7) wetlands. Nineteen primary, nine secondary, and six tertiary priorities were identified for these categories, with water supply having the highest number (five) of primary priorities. Research approaches were formulated for the identified priorities. (Zielinski-IPA)
W81-00288

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN: FISCAL YEARS 1982-1986,
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-126518, Price codes: A07 in paper copy, A01 in microfiche. Report submitted to Office of Water Research and Technology, 1980. 133 p, 6 Fig, 9 Tab, 66 Ref, 2 Append. 14-34-0001-0126.

Descriptors: *Research priorities, *Mississippi, *Water resources development, *Planning, *Water resources institute, Organizations, Water sources, State jurisdiction, State governments, Water supply, Research and development, Runoff, Storm runoff, Mississippi River, River basins, Floods, Water reuse, Streams, Droughts, Erosion, Wetlands, *Five-year plans.

The Mississippi Water Resources Research Institute has established a documented list of Mississippi water resources and related land-use problems, which has allowed for the development of prioritized research agenda and the identification of training and technology transfer activities to meet water resources needs. Current related activities by other agencies and organizations were identified and incorporated in the five-year research program. Identified problems include increased water demands causing geographically critical shortages annually; water quality impact on community surface waters by inadequate waste water treatment capacities and stormwater runoff; river basin flooding and erosion/sedimentation; and interstate and industry/municipality/agriculture intrastate conflicts over water use. The eight identified program elements covering on-going/proposed activities addressing these problem areas were: water conservation and reuse; water resources planning and management; maintenance of flows for stream uses; energy development impacts; water requirements for food and fiber production; flood and drought damage; wetlands protection; and water quality protection. (Zielinski-IPA)
W81-00289

WATER RESOURCES RESEARCH SUPPORT PROGRAM 1979-1980,
Inland Waters Directorate, Ottawa (Ontario).
For primary bibliographic entry see Field 6E.
W81-00383

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*U.S. GOVERNMENT PRINTING OFFICE: 1981-0-341-011/10

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 14, NUMBERS 3 & 4
FEBRUARY 15, 1981

W81-00501 -- W81-00750
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

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Volume 14, Numbers 3 and 4 are combined in this issue. Some future issues may also be combined until normal input flow is resumed.

SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

VOLUME 14, NUMBERS 3 & 4
FEBRUARY 15, 1981

W81-00501 -- W81-00750

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

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Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

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Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

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SELECTED WATER RESOURCES ABSTRACTS

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2A. General

BASIN DEVELOPMENT AND WATER ALLOCATION,
Nevada Univ. System, Reno. Desert Research Inst.
For primary bibliographic entry see Field 6A.
W81-00514

2C. Snow, Ice, and Frost

VARIABLE SOURCES OF SUSPENDED SEDIMENT AND NUTRIENTS FROM SMALL WATERSHEDS,
Max C. Fleischmann Coll. of Agriculture, Reno, NV.
For primary bibliographic entry see Field 5A.
W81-00638

2D. Evaporation and Transpiration

BATHYMETRIC STUDIES ON THE PONGOLO RIVER FLOOD PLAIN,
Natal Univ., Pietermaritzburg, (South Africa).
C. M. Breen, H. D. Furness, J. Heeg, and J. Kok.
Journal of the Limnological Society of Southern Africa (Bloemfontein), Vol 4, No 2, p 95-100, 1978, 5 Fig, 4 Tab, 15 Ref.

Descriptors: *Standing waters, *Flood plains, *Evaporation, *Surveys, *Bathymetry, *Limnology, *Fish farming, Rivers, Surface waters, Lake morphology, Sediments, Thermocline, Water levels, Vegetation, Thermal properties, Ecology, Maps, Sampling, Water loss, Drying, Seasonal, Rainfall, Flood frequency, Flood peak, Fish populations, Sounding, South Africa.

The morphology and ecological characteristics of thirteen of the major pans on the Pongolo River, South Africa, were surveyed and the suitability of various pans for fish production was assessed. During high flood levels (HFL) related to allochthonous inputs, the pans or floodplain basins fill with water and most of the pans retain what has been classified as a maximum retention level (MRL) of water throughout the dry season. Floods inundate about 1000 hectares around the pans. Most of the pans are shallow, less than 2.5 meters deep, yet most of them do not dry out. Depth soundings of the pans were made from an open boat and transferred to 1:600 trignometric survey maps. The floodplain is located in an area where rainfall is seasonal and the evaporative demand is high. Water levels are therefore flood dependent and drop below MRL in the dry season, exposing Cynodon dactyeon which can be used for grazing. Pans with a large volume and shallow depth would be suitable for fish production. (Sidney-IPA)
W81-00734

2E. Streamflow and Runoff

A BASEFLOW SIMULATION MODEL,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
S. E. Hogg, A. G. Thompson, and W. D. Striffler.
In: Proceedings, Watershed Management Symposium. Boise, Idaho, July 21-23, 1980, Vol II, p 755-763, (1980). American Society of Civil Engineers, 345 E. 47th St. New York, NY 10017. OWRT-B-160-Colo(6).

Descriptors: *Base flow, *Model studies, *Streamflow, *Subsurface flow, Simulation analysis, Surface-groundwater relationships, Hydrographs, Watersheds(Basins), Colorado, Rocky Mountains.

A model is presented in which streamflow is simulated at selected arbitrary points along the stream channel. The area of watershed contributing to streamflow between any two points along the channel is defined as a hydrologic response unit. A parameter deck is automatically generated from digital terrain models containing information on topography, vegetation, soils and response unit boundaries. Streamflow contibution is then simulated for each response unit in the watershed. Streamflow is generated according to the dynamic contributing area concept of runoff, incorporating lateral subsurface flow in the channel. The emphasis of the model is on generation of baseflow from groundwater and lateral subsurface flow in the soil. Hydrographs are shown for streamflow in the Williams Fork watershed, near Parshall, Colorado at various points along the channel, as well as for the entire watershed. The model was initially developed for watersheds in the Colorado Rockies but is to be extended elsewhere.
W81-00516

ECOLOGICAL COMPARISON OF INTERMITTENT STREAMS IN DIFFERENT LAND USE PATTERNS IN NORTHEASTERN ILLINOIS,
Louisville Univ., KY. Systems Science Centre.
W. J. Mitsch, and D. A. Urbikas.
University of Louisville, Illinois Institute of Natural Resources, Chicago, Document No 80/17, September 1980. 154 p, 28 Fig, 24 Tab, 65 Ref.

Descriptors: *Illinois, *Intermittent streams, *Watershed management, *Land use, Effects, Streamflow, *Ecosystems, Benthic flora, Benthic fauna, Food chains, Invertebrates, Forecasting, Tubidity, Low-flow frequency.

An assessment of the contribution of intermittent streams is needed since these streams may have a profound effect on the downstream community and the ecology of the larger watershed. Five types of land-use watersheds were chosen: agricultural, residential, industrial, urban/commercial, and forested. The major characteristics of the five streams are presented under physical, chemical and biological headings. Streamflow is the most important physical characteristic; its quantitative value is a direct result of precipitation and soil infiltration. During the 5-month sampling period, water samples, flow measurements and benthic invertebrate samples were taken. Relationships between the benthic invertebrate community and time, streamflow, velocity, stream depth, dissolved oxygen, temperature and turbidity are discussed. The study concludes that a total watershed approach must be involved, including seemingly insignificant intermittent streams, in the study of larger stream systems. Any man-made alterations in flow patterns for these streams must be viewed with this downstream effect in mind as well as the immediate effect on the intermittent stream itself. Small ecosystems cannot tolerate sudden changes, while gradual, cumulative changes can be somewhat unobtrusively passed on to the downstream ecosystem. These effects, however, are often not realized until much damage has already occurred. Preliminary stream energy models were developed from the data and allow for some predictive capacity to prevent irreversible detrimental effects. (Atkins-Omniplan)
W81-00645

ANALYSIS OF STREAM QUALITY IN THE YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-00660

LOW-FLOW CHARACTERISTICS OF LOUISIANA STREAMS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
M. J. Forbes, Jr.
Louisiana Department of Transportation and Development, Office of Public Works Water Resources Technical Report No 22, 1980. 95 p, 2 Fig, 1 Plate, 4 Tab, 9 Ref.

Descriptors: *Low flow, *Flow characteristics, *Streamflow, *Louisiana, Gaging stations, Flow measurement, Statistics, Frequency analysis, Correlation analysis, Low-flow frequency, Flow rates, Hydrologic data, Log Pearson type III distribution, Climatic year, Continuous-record stations, Partial-record stations.

This report presents annual and monthly statistics of low flow for 114 streamflow stations in Louisiana for which continuous records of discharge are available and annual statistics for 245 stations (partial record) at which intermittent measurements of low flow have been made. Independent calculations of statistics for continuous-record stations were made using the log-Pearson type III distribution. Statistics for partial-record stations were determined by a regression of discharges at those stations with discharges at continuous-record stations. (USGS)
W81-00665

EVALUATION OF SELECTED DAM-BREAK FLOOD-WAVE MODELS BY USING FIELD DATA,
Geological Survey, NSTL Station, MS. Water Resources Div.
L. F. Land.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115776, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-44, July 1980. 54 p, 14 Fig, 6 Tab, 19 Ref.

Descriptors: *Floods, *Dam failure, *Model studies, *Mathematical models, Evaluation, Flood forecasting, Flood discharge, Peak discharge, Hydraulic properties, Hydrodynamis, Continuity equation,Momentum equation, Flood routing, *Teton Dam(ID), *Johnstown(PA), *Tocca Falls(GA).

Four dam-break flood-wave models have been evaluated by using three field data sets and selected criteria of desirable features. The models include (1) modified Puls (MP), (2) U.S. Army Corps of Engineers' unsteady flow profiles (USTFLO), (3) National Weather Services' dam-break flood forecast (DBFF), and (4) U.S. Geological Survey's coupled method of characteristics and a general purpose streamflow simulation (M0D-J879DB). The field data sets documented the disasters at Teton Dam, Idaho, Laurel Run, Pa., and Toccoa Falls, Ga. The computed discharges were often within 20% of the observed values with the exception of the simulations at Teton Dam and for a short distance below the dams by the M0C-J879DB. With the same exceptions noted above, the computed flood crests were usually within 2 feet of the observed high-water marks. A modified version of the DBFF model is identified as giving the best results. Overall, it was the most accurate, economical, flexible, numerically stable, easiest to apply, and descriptive of the boundary and flow conditions. (USGS)
W81-00666

FLOOD MAGNITUDE AND FREQUENCY OF STREAMS IN INDIANA: PRELIMINARY ESTIMATING EQUATIONS,
Geological Survey, Indianapolis, IN. Water Resources Div.
R. L. Gold.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, $6.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-759, July, 1980. 44 p, 2 Fig, 2 Tab, 5 Ref.

Descriptors: *Floods, *Flood frequency, *Streams, *Indiana, Illinois, Estimating equations, Regression analysis, Peak discharge, Flood peak, Streamflow, Gaging stations, Sites, Flood recurrence interval, Basin characteristics.

This interim report presents preliminary estimating equations developed for the ongoing study, 'Flood Frequency of Small Streams in Indiana.' The equations were developed by the multiple-regression technique from data collected at 57 crest-stage-gage and 15 rainfall-runoff sites in the study and from 133 streamflow stations in Indiana and 11 in eastern Illinois. Peak discharge was used as the dependent variable, and basin characteristics were used as the independent variables in the analysis. Drainage area and precipitation were the most significant basin characteristics. (USGS)

W81-00667

PREDICTING NORMAL MIMIMUM-FLOW RATES FOR UNGAGED STREAMS IN WEST VIRGINIA,
West Virginia Univ., Morgantown. Water Research Inst.
R. Lee, H. W. Rauch, D. G. Boyer, and E. Snyder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138000, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, 1980. 73 p, 1 Fig, 17 Tab, 67 Ref. OWRT-A-038-WVA(1), 14-34-0001-9052.

Descriptors: *Base flow, Gaging, *Low flow, Low-flow frequency, Mathematical models, Statistical models, *Streamflow forecasting, Climatology, Frequency analysis, Geologic control, Geomorphology, Statistical methods, Synthetic hydrology, Topography, Watersheds(Basins), *West Virginia, *Ungaged Streams.

Comprehensive analyses of a wide range of watershed characteristics were conducted in order to develop deterministic relationships and statistical models for predicting normal minimum flow rates in ungaged West Virginia streams. Preliminary studies demonstrated that the widely used Q7-10 parameter is inherently unstable; its variability for 25-year intervals within a 50-year period of record was about 30% (plus or minus 15%). Water balance computations were significantly improved by the revision of the isohyetal map of normal annual precipitation, and it was shown that derived relationships for normal annual discharge, seasonal flow recession, and seasonal storage fluctuations could be obtained from easily available data. Statistical models incorporating basin area, normal annual discharge, and a seasonal recession constant were effective in estimating Q7-10 with an accuracy as great as the consistency of the variable itself. Of the geologic variables tested, area of carbonate rock was most highly correlated with low-flow parameters (Q7-10 and Q7-2); in eastern West Virginia, carbonate rock exposure is highly correlated with the seasonal recession constant, and may be used interchangeably for low-flow predictions.
W81-00685

MEASUREMENT OF WATER FLOW RATE,
Department of Agriculture, Washington, DC. Office of the Secretary. (Assignee).
J. A. Replogle, A. J. Clemmens, and E. D. Bell.
U.S. Patent No 4,195,519, 6 p, 3 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 60, April 1, 1980.

Descriptors: *Patents, *Channel flow, *Flow measurement, Flow rates, Water level, Flow control, Equipment.

Water flow rate in channelized, flowing bodies of water is measured by first obstructing the flow of water in the body causing a rise in the water surface upstream from the obstruction. This rise in upstream water surface is communicated to a point above the obstruction and measured there. The measurement is then converted to a water flow rate. A device for measuring water flow rate includes means for producing an obstruction in water flow in the body of water thus causing a rise in the water surface upstream from the obstruction, means for communicating the rise in upstream water surface to a point above the obstruction, and means for measuring the rise at that point, all secured to a frame. (Sinha - OEIS)
W81-00714

2F. Groundwater

ENVIROMENTAL CONTROLS ON OCCURRENCE AND CHEMISTRY OF GROUNDWATER IN A CARBONATE TERRANE OF EASTERN NEVADA,
Fugro, Inc., Long Beach, CA.
C. A. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131112, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Center, University of Nevada, Reno, Publication No 41066, 1980. 101 p, 16 Fig, 6 Tab, 43 Ref, 3 Append. OWRT-B-045-NEV(1), 14-31-0001-3303.

Descriptors: *Groundwater movement, *Groundwater sources, *Geochemistry, *Springs, *Carbonate rocks, Aquifer characteristics, Water quality, Water supply, Arid lands, Groundwater recharge, Snowmelt, Discharge(Water), *Nevada.

Definition of carbonate aquifer characteristics in arid regions is important to a better understanding of water supply sources in Nevada. A description is provided of the identification and interpretation of environmental factors which influence the quantity and chemistry of groundwaters discharging from carbonate terrane in eastern Nevada. Primary controls are geologic structure, mineralogy and physical properties of rocks, and climate. Springs which demonstrate a seasonal cyclic variation in discharge but relatively constant chemistry drain a large-scale area-wide flow system. Amount of snowfall, seasonal temperature, and mineralogy of rocks are most infuluential on solution activity of groundwater, and ultimate chemical quality and discharge of spring waters. (Schulke-Nev)
W81-00637

RESULTS OF COMPUTER MODELING OF GROUNDWATER FLOW - THE CALCIUM CARBONATE AQUIFER OF THE CENTRAL ROSWELL BASIN,
New Mexico Inst. of Mining and Technology, Socorro.
K. R. Rehfeldt.
In: A Quarter Century of Water Research, Proceedings of the Twenty-Fifth Annual New Mexico Water Conference, Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 78-104, 9 Fig, 16 Ref. New Mexico Water Resources Research Institute, New Mexico State University, Box 3167, Las Cruces, NM 88003.

Descriptors: *New Mexico, *Groundwater movement, *Calcium carbonate, *Model studies, Simulation analysis, Transmissivity, Storage coefficient, *Aquifers, Recharge, Infiltration, Precipitation intensity, Tritium, Water distribution, Computer models, Water table.

The flow of groundwater in the Roswell Artesian Basin has been studied since the early 1900's with varied ideas proposed to explain different aspects of the ground-water flow system. The distribution and sources of recharge to the Roswell Basin are delineated using a computer model to simulate groundwater flow in the carbonate aquifer beneath and west of Roswell and in the Glorieta Sandstone and Yeso Formation west of the carbonate aquifer. The effect of precipitation was shown to be small (20%) with deep flow---particularly from the Glorieta Sandstone---appearing to be the major component of recharge. Model parameters include transmissivity, storage coefficient., interaquifer leakage, and recharge. The computer model chosen was a two-dimensional finite-difference model written by Trescott, Pinder and Larson. (Garrison-Omniplan)
W81-00642

STRUCTURE CONTOUR MAP OF THE MADISON GROUP, HAVRE 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00652

STRUCTURE CONTOUR MAP OF THE TOP OF THE MADISON GROUP, GREAT FALLS 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00653

STRUCTURE CONTOUR MAP OF THE TOP OF THE MADISON GROUP, SHELBY 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00654

AQUIFER TESTS OF THE NAVAJO SANDSTONE NEAR CAINEVILLE, WAYNE COUNTY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
J. W. Hood, and T. W. Danielson.
Utah Department of Natural Resources Technical Publication No 66, 1979. 69 p, 18 Fig, 11 Tab, 18 Ref.

Descriptors: *Aquifer testing, Groundwater, *Hydrogeology, *Geohydrologic units, *Aquifer characteristics, Isotropy, Leakage, Hydraulic conductivity, Transmissivity, Storage coefficient, Specific yield, Chemical analysis, Logging(Recording), Hydrologic data, Utah, *Navajo Sandstone, *Wayne County(UT), *Dirty Devil River basin(UT).

The Navajo Sandstone near Cainesville in Wayne County, Utah, is the major aquifer in a section of Mesozoic and Paleozoic sedimentary rocks that is at least 7,160 feet thick. Water in the sandstone is under high artesian pressure. Of two partially penetrating test wells, one yielded 2,800 and the other, 3,110 gallons per minute. The Navajo Sanstone is massive, crossbedded, very fine to fine grained, and approximately 900 ft thick. For the practical purpose, of aquifer analysis, it is hydraulically isotropic in unfractured parts. The average hydraulic conductivity is 0.5 foot per day, and the inferred transmissivity is 450 feet squared per day. Folding has fractured some of the sandstone. The result is enhanced permeability, gross anisotropy of the sandstone, and upward leakage of saline water from underlying formations. Discharging-well tests yield values for transmissivity between 1,330 and 4,250 feet squared per day. Generalized values for transmissivity and storage coefficient that were selected for calculation of long-term pumping effects are 1,500 feet squared per day and 0.001. The specific yield is estimated to be between 5 and 10%. (USGS)
W81-00657

GROUND-WATER HYDROLOGY OF THE DADE CITY AREA, PASCO COUNTY, FLORIDA, WITH EMPHASIS ON THE HYDROLOGIC EFFECTS OF PUMPING FROM THE FLORIDAN AQUIFER,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-00661

RECORDS OF GROUND-WATER RECHARGE AND DISCHARGE, 1934-78; WATER LEVELS, 1975-78; AND CHEMICAL QUALITY OF WATER, 1977-78, FOR THE EDWARDS AQUIFER IN THE SAN ANTONIO AREA, TEXAS.
Geological Survey, San Antonio, TX. Water Resources Div.
Edwards Underground Water District Bulletin 38, July, 1980. 53 p, 4 Fig, 7 Tab, 71 Ref. (Reeves, R. D., Maclay, R. W., Grimm, K. C., and Davis, M. F., compilers).

Descriptors: *Groundwater recharge, *Water yield, *Water level fluctuations, *Water quality, *Aquifers, Water storage, Precipitation(Atmospheric), Drainage area, Observation wells, Data collections, Sites, Water analysis, Hydrogeology, Maps, Texas, *Edwards aquifer(TX), *San Antonio area(TX).

The average annual ground-water recharge to the Edwards aquifer in the San Antonio area, Texas, from 1934 through 1978 was 587,200 acre-feet. The recharge in 1978 was 502,500 acre-feet, ending a trend of above average recharge that began in 1968. A maximum annual recharge of 1,711,200

acre-feet occurred in 1958, and a minimum annual recharge of 43,700 acre-feet occurred in 1956. A maximum annual discharge of 960,900 acre-feet occurred in 1977, and a minimum annual discharge of 388,800 acre-feet occurred in 1955. The maximum annual discharge by wells was 431,800 acre-feet in 1978, which is a record high for the 1934-78 period. Although water levels in wells in the Edwards aquifer showed a general decline in 1978, the volume of ground water in storage in the aquifer was above average. Analyses of water samples from 72 wells and 3 springs show no evidence of significant degradation of water quality in the Edwards aquifer, and the data show no trend of degradation in water quality. (USGS)
W81-00668

2H. Lakes

THE INFLUENCE OF RIVER WATER QUALITY ON STORAGE RESERVOIR MANAGEMENT,
California Univ., Berkeley.
H. B. Fischer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-128688, Price codes: A02 in paper copy, A01 in microfiche. Technical Completion Report, August 1980. 9 p. 8 Ref. W-525.

Descriptors: *Reservoirs, *Surface waters, *Epilimnion, *Hypolimniom, *Rivers, Winds, Meteorology, Water quality, Turbulence, Mixing, Temperature.

Summary of work conducted from June 1977 to June 1980 on numerical modelling used to predict water quality in small- and medium-sized reservoirs. Three aspects of the fluid mechanics of constituent transport to these sized reservoirs are examined in this basic research project: (1) deepening of the epilimnion caused by Kelvin-Helmholtz billowing (Spigel's thesis); (2) mixing in the hypolimnion caused by sidewall turbulence (Ivey's theses); and (3) the effect of unsteady surface winds (Monismith's thesis). The results of part 1 have already been incorporated into the general model, DYRESM; part 2 has just been completed but not yet incorporated into DYRESM; and part 3 is still underway. (Garrison-Omniplan)
W81-00515

SAVING THE LAKES,
Washington State Water Research Center, Pullman.
D. C. Flaherty.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131138, Price codes: A03 in paper copy, A01 in microfiche. Report, June, 1980. 45 p, 27 Fig. OWRT-C-90009-T(No 0415)(1), 14-34-0001-0415.

Descriptors: *Lakes, *Washington, *Water pollution treatment, *Water pollution effects, *Sewage treatment, *Water quality, Pacific coasts region, Water Resources Research Act, Sewage effluents, Water pollution, Pollutants, Ecosystems, Water quality control, Water purification, Natural resources, Water pollution control, Eutrophication, Lake stages.

Washington freshwater lakes had earlier been receiving nutrients and other pollutants that threatened their pristine conditon and has placed several lakes on the verge of eutrophication. Significant developments have since occurred that have enabled significant progress in rehabilitating Washington freshwater lakes. Research studies had involved Liberty Lake, Laker Coeur d' Alene, Lake Washington, Lake Sammamish, Moses Lake, Long Lake, and Newman and Williams Lakes. Lake research is continuing. Sewers and sewage-treatment plants are being constructed to intercept nutrients and other pollutants which formerly entered the lakes unchecked. This document covered separate reports on each of the major Washington lakes. A bibliography of the resulting technical literature has been provided following the discussion of each lake project. Revival of ecological health in Washington lakes has been made possible by the 1964 Water Resources Research Act, Federal and State support of research projects, and increased university student interest and involvement. Specific remedies used to improve lake water quality and ecology were covered. (Zielinski-IPA)
W81-00549

A LIMNOLOGICAL INVESTIGATION OF LAKE LIAMBEZI, CAPRIVI,
National Inst. for Water Research, Pretoria (South Africa).
M. T. Seaman, W. E. Scott, R. D. Walmsley, B. C. W. van der Waal, and D. F. Toerien.
Journal of the Limnological Society of Southern Africa (Bloemfontein), Vol 4, No 2, p 129-144, 1978. 18 Fig, 8 Tab, 52 Ref.

Descriptors: *Lakes, *Limnology, *Biological properties, *Tropic, *Chemical properties, *Physical properties, *Fish management, Turbidity currents, Swamps, Temperature, Surface waters, Sediments, Sampling, Conductivity, Alkalinity, Nitrogen compounds, Phosphorus compounds, Erosion, Erosion control, Algae, Cyanophyta, Silting, Lake basin, Humic acids, Oxygen requirements, Littoral, Vegetation, South Africa, Lake Liambezi(South Africa).

The physical, chemical and biological characteristics of the tropical Lake Liambezi, Caprivi, were studied to determine the fishery potential of the lake and its limnology. The lake is shallow (less than 5 meters) and the depth is fairly constant in the open water. The area of the lake, some 101 square km is surrounded by thick reed swamps and channels, particularly on the south-western shore. Seven sampling stations were established to collect water and bottom samples. High oxygen levels were found at all depths, although photosynthetic activity in the waters was not particularly high. Surface water temperatures ranged from a winter minimum of 15C to a summer maximum of 31C and the pH of the water was fairly alkaline. The conductivity ranged from 17.3 to 41.2 mS per meter. Waters in the reed swamp were brown due to humic substances and high levels of organic nitrogen and phosphorus were also present because of erosion of the lake basin and siltation on the reed swamp side. Planktonic chlorophyll a levels ranged from 1 to 104 microgram per liter with Microcystis as the dominant phytoplankter and the dominant zooplankter was Bosmina. Two new species of blue-green algae were detected. Erosion of the lake basin and the progressive encroachment by Salvinia must be halted if the fishery potential of the lake is to be exploited. (Sidney-IPA)
W81-00551

PLAYA LAKES CHARACTERIZATION STUDY,
Fish and Wildlife Service, Fort Worth, TX.
D. Curtis, and H. Beierman.
Planning aid report to Water and Power Resources Service, September 1980. 56 p, 11 Fig, 13 tab, 27 Ref. 9228/340/06.

Descriptors: *Playas, *Wildlife, *Vegetation, *Limnology, Geomorphology, Land use, Waterfowl, Water resources, Water conservation, Wildlife habitats, Habitat improvement, Agriculture, Wetlands, Persistence, Colorado, Kansas, Oklahoma, New Mexico, Texas, Llano Estacado.

Because of the potential of playa lakes to provide a supplemental water supply for the Southern High Plains, biological and physical data gathered on 116 playas in the Llano Estacado study area are analyzed. The study area includes the southeast corner of Colorado, the soutwest corner of Kansas, the High Plains portion of western Oklahoma, eastern New Mexico, and northwestern Texas. Current land use of playa basins, playa lake persistence, soils, physiography, alterations of playa basins, water quality, wetlands classification, vegetation, wildlife values, historical condition of playas and historical waterfowl use were determined through field observations and landowner interviews. Playas in the study area provide habitat diversity and produce significant numbers of waterfowl. Economic agricultural benefits can be provided through water conservation practices, while maintaining quality wildlife habitat. Wildlife management measures are recommended for playas which allow for agricultural considerations in their implementation. (Moore - SRC)
W81-00554

DYNAMICS OF DISSOLVED OXYGEN DURING ALGAL BLOOM IN LAKE KASUMIGAURA, JAPAN,
Tsukuba Univ., Ibaraki (Japan). Inst. of Biological Sciences.
H. Seki, M. Takahashi, Y. Hara, and S. Ichimura.
Water Research, Vol 14, No 2, p 179-183, February, 1980. 4 Fig, 4 Tab, 14 Ref.

Descriptors: *Aquatic algae, *Dissolved oxygen, *Stratification, *Lakes, *On-site tests, *Respiration, Eutrophication, Photosynthesis, Phytoplankton, Photosynthetic oxygen, Biochemical oxygen demand, Nitrogen, Nutrients, Phosphorus, Hydrogen ion concentration, Adenosine triphosphate, Light intensity, Euphotic zone, Photometry, Japan, Lake Kasumigaura.

The dynamics of dissolved oxygen (DO) during an algal bloom on Lake Kasumigaura, Japan were studied during a 2-day period in August, 1977. Water samples were collected during an algal bloom every 4 hr at Ibaraki Freshwater Fisheries Experiment Station. Oxygen increases due to photosynthesis were measured in situ in a BOD bottle. A darkened bottle was used to measure any respiration occurring simultaneously with photosynthesis. An Aminco Chemo-Glow-Photometer was used to determine adenosine triphosphate (ATP), nitrate, nitrite, ammonium, and reactive phosphorus. Chlorophyll a levels, pH, redox potential, light intensity, bacterial count, and temperature were also monitored. Phytoplankters of the euphotic zone showed no change in vertical distribution during the study period. DO increased in shallower waters above 60 cm after dawn and reached its peak (190% of saturation) at 12:00, gradually decreasing thereafter. Inorganic nutrients exhibited no stratification during the study period. Nitrogen was the controlling nutrient of the algal bloom activity. The increase in DO by photosynthesis was greater than the decrease of DO by respiration at any depth within the euphotic zone. In the hyperoxygenative zone, most of the excess oxygen from photosythesis was liberated from surface waters into the atmosphere or was consumed by microorganisms. The deeper hypooxygenative layer received oxygen from the hyperoxygenative layer. (Geiger-FRC)
W81-00635

REDUCTIONS IN INACTIVATION RATES OF BACERIOPHAGES BY CLAY MINERALS IN LAKE WATER,
New York Univ., NY. Lab. of Microbial Ecology.
For primary bibliographic entry see Field 5G.
W81-00636

ESTIMATED INFLOW AND EVAPORATION FOR GREAT SALT LAKE, UTAH, 1931-76, WITH REVISED MODEL FOR EVALUATING THE EFFECTS OF DIKES ON THE WATER AND SALT BALANCE OF THE LAKE,
Geological Survey, Salt Lake City, UT. Water Resources Div.
K. M. Waddell, and J. D. Barton.
Utah Division of Water Resources Cooperative Investigation Report No 20, 1980. 57 p, 9 Fig, 13 Tab, 5 Ref.

Descriptors: *Model studies, *Great Salt Lake, *Utah, *Water balance, *Salt balance, Hydrologic budget, Saline lakes, Surface waters, Goundwater, Estimating, Inflow, Evaporation, Precipitation(Atmospheric), Dikes, Computer programs, Mathematical models.

A water budget for Great Salt Lake, Utah, was computed with 1-month intervals for the 46-year period of 1931-76. This budget updates previous computations for 1931-73 on the basis of additional data collected during 1974-76. The storage change during each month was computed from a budget of

surface inflow, groundwater inflow, precipitation on the lake surface, a calibration parameter representing the net deficit between the estimated net inflows and the observed net inflows as computed from the observed altitude hydrograph, and outflow from evaporation. Based on additional pan-evaporation data collected at six sites around the perimeter of the lake, estimates of evaporation rates were reduced about 8%. The annual evaporation ranged from about 2.1 to 3.9 million acre-feet and averaged 2.9 million acre-feet. Based on additional surface-inflow data collected during 1974-76, the annual surface inflow to the lake for 1931-76 ranged from 705,200 (1934) to 3,767,000 (1971) acre-feet and averaged 1,926,000 acre-feet. No changes were made to the 1931-73 estimates of precipitation on the lake surface or to the estimate of ground-water inflow. These averaged 870,000 and 75,000 acre-feet per year, respectively. The total annual inflow to Great Salt Lake during 1931-76 ranged from about 1.3 (1961) to 5.0 (1971 and 1975) million acre-feet and averaged 2.9 million acre-feet. (USGS)
W81-00658

TERRESTRIAL-AQUATIC LINKAGES, COMPONENT INTERACTIONS AND POTENTIAL RESTRICTION OF GROWTH OF THE INTRODUCED AQUATIC WEED MYRIOPHYLLUM SPICATUM L. (WATER MILFOIL) I,
Tennessee Univ., Knoxville.
C. C. Amundsen, A Brenkert, and M. C. Bruner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142218, Price codes: A03 in paper copy, A01 in microfiche. Tennessee Water Resources Research Center, University of Tennessee Research Report No 80, April, 1980. 23 p, 1 Fig, 4 Tab, 23 Ref. OWRT-B-042-TENN(1), 14-34-0001-9097.

Descriptors: *Aquatic weed control, *Aquatic weeds, Rooted aquatic plants, *Environmental effects, *Reservoirs, Organic matter, Sediments, Land use, Inflow, Nutrients, Tennessee Valley Authority, *Melton Hill Reservoir(TN), Eurasian Watermilfoil.

Knowledge of plant-sediment interactions is necessary for sound management programs of Eurasion Watermilfoil (Myriophyllum spicatum L.). An investigation of plant and sediment characteristics of TVA Melton Hill Reservoir has been continued in order to further elucidate these relationships. Watermilfoil and sediment samples were collected at five sites in the reservoir. In addition, pre-inundation aerial photographs were examined to determine what the land usage had been under extant watermilfoil beds. Land usage under the five sites sampled and almost all other Melton Hill watermilfoil beds was agricultural. Sediment organic matter, the best overall indicator of nutrient status, varied significantly between sites. Standing crop of watermilfoil also varied significantly with site and with season. A study site in a sheltered embayment had higher sediment organic matter and plant standing crop than the sites in the main reservoir channel. Further detailed nutrient analysis and experimental manipulation in the laboratory is anticipated to more clearly define the relationship of watermilfoil and the sediment.
W81-00687

NITROGEN LOADING: INFLUENCE ON DISSOLVED INORGANIC CARBON IN NATURAL WATERS,
Michigan Univ., Ann Arbor. Div of Biological Sciences.
J. T. Lehman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142226, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, East Lansing, Project Completion Report, December, 1980. 29 p, 7 Fig, 6 Tab, 28 Ref. OWRT A-109-MICH(1), 14-34-0001-0124.

Descriptors: *Alkalinity, *Inorganic carbon, *Nitrogen loading, *Third Sister Lake(MI), Michigan, Carbonate equilibria, Enclosure experiments, *Lakes, Phytoplankton, Respiration, Photosynthesis, Nitrates, Phosphates, Nutrients.

One of the links between physiological activities of phytoplankton and the dissolved inorganic carbon in natural waters is more subtle than the CO2-producing and CO2-consuming processes of respiration and photosynthesis. When phytoplankton absorb nutrients, particularly inorganic nitrogen, they can alter the alkalinity of the water thereby directly affecting the capacity of the system to retain inorganic carbon in solution. This can lead to large differences in both standing stocks and maximal sustained rates of primary production depending on the chemical form of N that is supplied. The extent of these differences have been examined using enclosures of natural lake water enriched with either ammonium or with nitrate in addition to phosphate. The experimental work is supplemented with analyses of lakes that have experienced severe changes in nitrogen loading.
W81-00688

FACTORS INFLUENCING VIABLE BACTERIA IN A TURBID MAN-MADE IMPOUNDMENT.
Orange Free State Univ., BLoemfontein (South Africa). Inst. of Environmental Science.
D. F. Toerien, D. N. Sadie, and P. Stegmann.
Journal of the Limnological Society of Southern Africa (Bloemfontein), Vol 4, No 2, p 89-94, 1978. 1 Fig, 6 Tab, 21 Ref.

Descriptors: *Aerobic bacteria, *Watersheds(Basins), *Dams, *Microbiology, *Fish farming, Surface waters, Least squares method, Sediments, Silting, Correlation analysis, Littoral, Vegetation, Organic compounds, Turbulence, Nutrients, Floods, Erosion, Suspended solids, Productivity, Management, Biomass, Turbidity, South Africa.

The factors which influence the activity of aerobic bacteria in the waters and sediments of the small silt-laden impoundment, Wuras Dam, South Africa, were studied with regard to possible fish production. Five sampling stations were selected in the impoundment and viable bacterial counts from water and soil samples were obtained. The bacterial counts of the bottom samples did not differ significantly from each other, but were much higher than the surface water samples. A significant positive correlation was obtained for suspensoid concentration and viable bacterial numbers suggesting that water turbulence and allochthonous inputs of suspensoids which may be very high during flood may increase the bacterial numbers. The viable bacterial number per milliliter was given as the regression line of 1854 times turbidity as milligrams Si02 per liter minus 3806. The dense stands of plants such as Phragmites and Typha in the littoral zone of the impoundment probably contributes organic matter on which the bacteria thrive. Based on the surface area and water content of the impoundment, the water and the top 2 cm of sediment could contain 19 and 28 tons of bacterial biomass respectively which could be available for the productivity cycle. The microbiology of turbid impoundment appears to be substantially different from that of clear water systems. (Sidney-IPA)
W81-00733

A CONCEPTUAL MODEL OF A SILTATION SYSTEM IN SHALLOW LAKES WITH LITTORAL VEGETATION,
Chile Univ., Santiago. Facultad de Ciencias.
P. J. Weisser.
Journal of the Limnological Society of Southern Africa (Bloemfontein), Vol 4, No 2, p 145-149, 1978. 5 Fig, 19 Ref.

Descriptors: *Lakes, *Shallow water, *Littoral, *Vegetation, *Silting, *Model studies, Sedimentation, Winds, Coriolis force, Wind velocity, Shores, Atmosphere, Energy, Lake basin, Nutrients, Invasion, Erosion control, Weed control, Distribution, Estimating, Management, Marsh management, Turbidity currents, Austria, Malawi.

The uneven distribution patterns of macrophytes in shallow lakes with littoral vegetation is explained by a conceptual siltation model. Turbulence in a shallow lake caused by strong winds produces erosion of the lake floor and suspension of the silt particles. These silt particles are transported by means of water drift into the littoral vegetation where the silt is deposited. The siltation pattern in Lake Neusiedlersee, Austria, was observed and the prevailing NW winds favored siltation in the southern part of the lake. No silting occurred on the steep eastern shores. The siltation model consists of four elements: the atmosphere, the lake basin, the open water surface, and the littoral vegetation. Energy is supplied to the system by the wind, the Coriolis force due to the rotation of the earth and gravity. Different areas of the lake littoral are unequally favored by the siltation mechanism because of the combination of prevailing winds and the deflection caused by Coriolis force. This results in an uneven distribution of nutrients which foster weed growth. Changes in water-level will affect the whole system of siltation and reeds-wamp advancement. The model explains the distribution of the vegetation in lakes Neusiedlersee (Austria) and Chilwa (Malawi) and suggest management options such as raising the water level, creating steeper shores, and fortifying the lake basin to prevent weed encroachment. (Sidney-IPA)
W81-00739

2J. Erosion and Sedimentation

DEVELOPMENT AND APPLICATION OF A FIELD INSTRUMENTATION SYSTEM FOR THE INVESTIGATION OF SURF ZONE HYDRODYNAMICS,
Woods Hole Oceanographic Institution, MA. Dept. of Ocean Engineering.
M. N. Greer.
Dissertation, No WHOI-80-36, August 1980. 175 p, 6 Fig, 4 Tab, 37 Ref, 2 Append. SG-04-7-158-44079.

Descriptors: *Coasts, *Instrumentation, *Hydrodynamics, Ocean waves, Ocean currents, Current meters, Measurement, Maine, Surf zone, Coastal zone, Nearshore process, Sea Grant Program.

The development and application of an autonomous field instrumentation system consisting of four current meters and four wave gauges, along with a field monitor and digital recorder, is documented. Field measurements of waves and currents at four stations across the width of the surf zone were made; using this system at a beach along the southern coast of Maine. Spilling breakers translated across the surf zone, generated an observed net longshore current during the four hour measurement period. The subsequently analyzed data from this experiment showed a strong longshore current which varied across the width of the surf zone, having a maximum of about 15 cm/sec just inside the breaker line. A net offshore current was observed at all four stations, and averaged approximately 10 cm/sec to 15 cm/sec. Using a simplified force balance model for the generation of longshore currents on a plane, uniform beach, the data was further analyzed to investigate the validity and parameterization of the momentum flux forces and bottom friction forces within the surf zone. There was an observed shoreward loss in momentum flux across the width of the surf zone, from about 150,000 dynes/cm outside the breakers to near zero close to the shoreward extent of the surf zone. (NOAA)
W81-00518

RECONNAISSANCE OF CHEMICAL QUALITY OF SURFACE WATER AND FLUVIAL SEDIMENT IN THE DIRTY DEVIL RIVER BASIN, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 2K.
W81-00659

2K. Chemical Processes

ENVIROMENTAL CONTROLS ON OCCURRENCE AND CHEMISTRY OF GROUNDWATER IN A CARBONATE TERRANE OF EASTERN NEVADA,

Fugro, Inc., Long Beach, CA.
For primary bibliographic entry see Field 2F.
W81-00637

RECONNAISSANCE OF CHEMICAL QUALITY OF SURFACE WATER AND FLUVIAL SEDIMENT IN THE DIRTY DEVIL RIVER BASIN, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
J. C. Mundorff.
Utah Department of Natural Resources Technical Publication No 65, 1979. 132 p, 4 Fig, 3 Plates, 7 Tab, 21 Ref.

Descriptors: *Water quality, *Chemical analysis, *Surface waters, *Fluvial sediments, Streams, Sediment yield, Hydrologic data, Streamflow, Pollutant identification, Water supply, Hydrogeology, Utah, *Dirty Devil River basin(UT), *Upper Colorado River basin(UT).

This water-quality reconnaissance in the Dirty Devil River basin, Utah, covers an area of about 4,300 square miles. Data were obtained by the U.S. Geological Survey one or more times at 104 sites during the period from July 1975 to September 1976. The most pronounced change in chemical characteristics of water in streams in the Dirty Devil River basin occurs in a 15-mile reach of Muddy Creek between the major diversions 5 miles north of Emery and the point at which Highway I-70 crosses Muddy Creek. Dissolved-solids concentrations at the diversions are generally less than 300 milligrams per liter and at the lower end of the reach are commonly greater than 2,000 milligrams per liter. The Dirty Devil River, which is formed by the confluence of Muddy Creek and the Fremont River, has no perennial tributaries. Except during short periods of the thunderstorm runoff in tributaries, the flow is simply a composite of flow from Muddy Creek and the Fremont River. A few data on total coliform, fecal coliform, and fecal streptococci bacteria suggest a general absence of major biological pollution in the basin. Sediment discharge from the upper 1,000 square miles of the Fremont River basin and from the upper 400 square miles of Muddy Creek Basin is a very small part of sediment discharge of the Dirty Devil River. Less than half of the remaining 2,900 square miles of drainage area of the Dirty Devil River probably contributes most of the sediment that is discharged by the streams during a very small part of the time each year. (USGS)
W81-00659

RECORDS OF GROUND-WATER RECHARGE AND DISCHARGE, 1934-78; WATER LEVELS, 1975-78; AND CHEMICAL QUALITY OF WATER, 1977-78, FOR THE EDWARDS AQUIFER IN THE SAN ANTONIO AREA, TEXAS.
Geological Survey, San Antonio, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-00668

2L. Estuaries

HOLOCENE GEOMORPHIC EVOLUTION OF A BARRIER-SALT MARSH SYSTEM, SW DELAWARE BAY,
Ankara Univ., (Turkey). Dept. of Geography and Geology.
I. Kayan, and J. C. Kraft.
Southeastern Geology, Vol 20, No 2, p 79-100, March 1979. 15 Fig, 21 Ref.

Descriptors: *Geomorphology, *Estuaries, Barriers, Salt Marshes, *Sedimentology, Aerial photography, *Halocene, *Delaware Bay, Paleogeomorphology, Coastal processes, Sea Grant Program.

Delaware Bay is one of the larger estuaries along the eastern coast of North America. The paleogeomorphology of a portion of the southwest coast of Delaware Bay at Cedar Creek-Slaughter Beach has been delineated from airphoto studies, surface sedimentological and geomorphic studies of present day coastal envoronments, and sedimentological and paleontological studies of subsurface sediments of the latter half of the Holocene Epoch. Radiocarbon data from sedimentary environmental lithosomes clearly indicate that estuarine conditions existed in the study area around 5000 B.P. Studies of the sediments and the shapes of the sedimentary bodies encountered in a drilling program in a small area show that it is possible to make paleogeographic reconstructions of coastal zone environments during the Holocene in the Cedar Creek-Slaughter Beach area. It is possible to predict a rate of coastal erosion of approximately one meter per year in the area, based on observation of ongoing coastal processes and the geologic record of the last half of the Holocene. (NOAA)
W81-00517

DEVELOPMENT AND APPLICATION OF A FIELD INSTRUMENTATION SYSTEM FOR THE INVESTIGATION OF SURF ZONE HYDRODYNAMICS,
Woods Hole Oceanographic Institution, MA. Dept. of Ocean Engineering.
For primary bibliographic entry see Field 2J.
W81-00518

ANTHROPOGENIC INFLUENCE OF THE SEDIMENTARY REGIME OF AN URBAN ESTUARY - BOSTON HARBOR,
Woods Hole Oceanographic Insitution, MA. Dept. of Geology and Geophysics.
M. G. Fitzgerald.
Doctoral Dissertation No WHOI-80-38, September 1980. 299 p, 69 Fig, 14 Tab, 82 Ref, 2 Append. SG-04-7-158-4414, 04-8-M01-149, NA79AA-D-00102.

Descriptors: *Estuaries, *Sedimentation, *Waste disposal, *Water pollution effects, Massachusetts, Tides, Heavy metals, Estuarine environment, Effluents, Cities, *Boston Harbor(MA), Sea Grant Program.

Boston Harbor (and its approches) is a glacially carved, tidally dominated estuary in western Massachusetts Bay. Characterized by low river discharge and significant human impact, the harbor is typical of many bays and estuaries along the New England coast. Modern organic-rich sediments are accumulating in several depocenters at an estimated rate of 0.2-0.3 cm/yr. The high organic matter content (greater than 10%) of these modern sediments is attributed in part of anthropogenic wastes. Wastes rich in trace metals are discharged into the harbor from the sewage treatment facility at Deer Island and from numerous point sources in the Inner Harbor. Trace metal profiles in the bottom sediments reflect the increasing use and discharge of these metals during the past 100 years. Large variations in several cores may be related to circulation changes accompanying the closing of Shirley Gut in 1936. In the water column, silt and clay sized mineral grains are suspended together in organically bound agglomerates. The organic film binding these particles is a by-product of biological activity and aids in the deposition of particulates and pollutants. (NOAA)
W81-00519

WATER QUALITY OF TAMPA BAY, FLORIDA: JUNE 1972 - MAY 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-00662

EXTENSION OF TRANSIENT-FLOW MODEL OF THE SACRAMENTO RIVER AT SACRAMENTO, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. N. Oltmann.
Geological Survey Water-Resources Investigations 80-30, July 1980. 25 p, 13 Fig, 1 Tab, 4 Ref.

Descriptors: *Unsteady flow, *Tidal streams, *Model studies, *Streamflow, Tidal effects, Computer models, Simulaltion analysis, Methodology, Non-uniform flow, Open channel flow, Flow rates, Stream gages, *Sacramento River(CA), Sacramento-Hood tidal reach(CA).

The multiple-reach method-of-characteristics flow-simulaltion model that was successfully applied in 1976 to a 10.8-mile tide-affected reach of the Sacramento River, in California, from Sacramento to Freeport has been extended 10.5 miles farther downstream of Hood. The model reach was extended to improve the quality of the model's output during low-flow conditons for the streamflow station located at the upstream end of the reach, and to provide flow data at additonal sites farther downstream toward the San Francisco Bay system. The extension of the reach, however, has not improved the quality of the model's low-flow output but it has provided flow data for sites farther downstream on the Sacramento River. (USGS)
W81-00663

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PILOT PLANT STUDY ON MARINE MICROORGANISMS AND ORGANIC MATTER IN SEAWATER DESALINATION BY REVERSE OSMOSIS,
Permutit Co., Inc., Monmouth Junction, NJ.
A. B. Mindler, and S. T. Bateman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131468, Price codes: A07 in paper copy, A01 in microfiche. Report submitted to Office of Water Research and Technology, May 12, 1980. 130 p, 13 Fig, 2 Tab, 72 Ref, 4 Append. OWRT-C-80316-S(No 8538)(1), 14-34-0001-8538(1).

Descriptors: *Desalination, *Reverse osmosis, *Sea water, *Fouling, Pretreatment, *Marine organisms, *Organic matter, Chlorination, Dechlorination, Bacteria, Oxidation-reduction potential, Corrosion, *St. Croix, Virgin Islands.

A seawater desalination pilot plant was operated for one year under tropical conditions (St. Croix, U.S.V.I.) with emphasis on biological aspects. Pretreatment consisted of chlorination, in-line coagulation with iron sulfate, filtration, dechlorination with excess sodium bisulfite, and alkaline scale prevention by two methods operated in parallel. On-stream time was about 50%. The productivity of the 4 inch duPont B-10 hollow fiber permeator on pH adjusted feed decreased to 765 gpd (74% of projected productivity) in 2700 hours, and to 850 gpd (87% of projected productivity) in 4460 hours on the permeator on antiscalant feed. Rejections were in excess of 98.9 and 99.1%, respectively at 30% recovery. There was an increased amount of biological growth in the antiscalant system on pipelines, tanks and cartridge filters after dechlorination, compared to the acidified system. There was no evidence that this observed biofouling adversely affected either system in reverse osmosis performance. Autopsies performed on two permeators indicated the presence of iron oxide, copper, and silica, but little or no organic fouling. The bacteria counts were reduced by chlorination from about a million cells/ml in raw seawater to about a hundred/ml after filtration, but counts returned to near the original levels after dechlorination. Algae and protozoa were controlled by adding copper sulfate and excluding light. The pretreatment system changed the order of predomination of species of bacteria from a mixed variety to those with enchanced periphytic and slime-producing capability. A submerged glass slide technique was found useful for quantifying the periphytic organisms. T0C levels of 1.0 mg/1 were unchanged throughout the pretreatment process.
W81-00639

GRAVITY WASH COLUMN DESIGN, PROCUREMENT, AND INSTALLATION; FOL-

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

LOWED BY DEVELOPMENT TESTS OF THE MODIFIED SINGLE-STAGE DESALTING PILOT PLANT AT WRIGHTSVILLE BEACH, NORTH CAROLINA,
Avco System Div., Wilmington, MA.
R. J. Campbell, and E. W. Duvall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-136897, Price codes: A05 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology (1979). 72 p, 22 Fig, 3 Tab, 7 Ref. OWRT (No 7514)(1), 14-34-001-7514.

Descriptors: *Desalination apparatus, *Desalination plants, *Pilot plants, *Desalination processes, *Separation techniques, Saline water, Treatment, Water treatment, Water purification, Treatment facilities, Equipment, Research and Development, North Carolina, Desalination, Laboratory tests, Testing, Engineering structure, Instrumentation.

This was the final report of a project that covered the design, procurement and installation of a gravity wash column and other modifications to the existing 75,000 gallons per day Crystalex pilot plant located at Wrightsville Beach, North Carolina. Following modifications, development tests were conducted to evaluate plant performance with a gravity wash column. Earlier study had revealed that the large scale 5-foot diameter pressurized counterflow wash column with annular screen design has a number of problems. Use of a new 13-foot diameter gravity wash column design was based on laboratory test data. Laboratory test data and experience also indicated improvements could be made in level controls, pressure transmitters, blow seals, wash water ratio control, and other system areas, and such improvements were incorporated in the Wrightsville plant system. The major pilot plant problem area needing additional design development study annd testing is the configuration of the gravity wash column and its drain screen. Use of warm fluid passages appeared feasible to alleviate screen freezing problems in the pressurized wash column. Other options have been considered. Most of the modified pilot plant system performed reasonably well. Pending improvement for the wash column as outlined could result in the desired performance. (Zielinski-IPA)
W81-00689

3B. Water Yield Improvement

CREATING AND MAINTAINING A POOL OF FRESH WATER ON A TABULAR ICEBERG,
ITI Ltd., Paris (France). (Assignee).
G. L. Mougin.
U.S. Patent No 4,191,491, 4 p, 3 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 201, March 4, 1980.

Descriptors: *Patents, *Freshwater, Icebergs, Melt water, Solar radiation, Evaporation, Water sources.

Tabular icebergs can be used as a source of fresh water in arid regions if they are transported from the Artarctic to where there is a need for water. To help reduce the rate at which solar radiation melts the iceberg on its journey, pools of fresh water are maintained on its upper surface, thereby taking advantage of the fact that the latent heat of evaporation of water is about seven times that of fusion of ice. The pools are created by protecting a closed path on the surface of the iceberg from melting by means of flexible sheet material. The protected path then forms the walls of the pool. At its destination the iceberg's pools can be given a V-shaped bottom to help increase the rate at which the iceberg is turned into fresh water. (Sinha - OEIS)
W81-00537

3C. Use Of Water Of Impaired Quality

FIELD EXPERIMENTS ON APPLICATION OF TREATED MUNICIPAL WASTE WATERS TO VEGETATED LANDS,
Tehran Univ. (Iran).
M. Sanai, and J. Shayegan.
Water Pollution Control, Vol 79, No 1, p 126-135, 1980. 4 Fig, 3 Tab, 11 Ref.

Descriptors: *Waste water disposal, *Nutrients, *Crop production, *Return flow, *Irrigation effects, Soil contamination, Sewage treatment, Fertilizer, Alfalfa, Corn, Wheat, Potatoes, Irrigation programs, Impaired water use, Semiarid climates, Crop response.

Field experiments were conducted to determine long term ecological effects of spray irrigating crop land with secondary treated sewage. Chemical analyses of soil, plant tissues, fertilizer, and atmospheric precipitation as well as routine water quality tests were conducted on test plots of alfalfa, corn, potato and wheat over a three-year period. Plots were irrigated either with secondary effluent, freshwater with fertilizer, or freshwater alone. Field productivity and the balance of nitrogen, phosphate, potassium and other nutrients were measured. The crop yields obtained from waste water irrigated plots were consistently higher than yields obtained from waste water irrigated plots were consistently higher than yields from either freshwater irrigated plot. Findings suggest that uniform and gradual nutrient application during irrigation enchances productivity. Corn exhibited the highest productivity and greatest potential for nutrient removal under waste irrigation. A gradual increase in phosphorous concentrations in the soil was observed over three years which suggests possible long term soil pollution and toxicity if nutrient application is not controlled. The irrigation method demonstrates highly efficient nutrient removal and has particular application in semi-arid agricultural areas. (Titus-FRC)
W81-00620

PLANNING REPORT FOR THE IRRIGATION PORTION OF A DUAL WATER SYSTEM FOR WEST JORDAN CITY, SALT LAKE COUNTY, UTAH,
Utah Div. of Water Resources, Salt Lake City.
B. C. Saunders, K. Arthur, and L. Summers.
Report, August, 1980. 33 p, 6 Fig, 1 Ref.

Descriptors: *Utah, *Irrigation design, *Beneficial use, *Municipal water, *Economic feasibility, Water supply, Lakes, *Comprehensive planning, Financial feasibility, Projections, Water demand, Multiple purpose projects, Cost estimates, Task force, Impaired water quality, *Impaired water use, Jordan City area(UT).

As agricultural demand for Utah Lake water in Salt Lake County diminishes because of urbanization, local water management agencies are investigating how the excess low-quality water can be used beneficially. A feasibility analysis was conducted to determine if the water could be used for lawns and gardens. Installing a pressurized irrigation system for lawns and gardens, leaving the present high-quality water for culinary requirements only, would significantly extend the life of the present high-quality water system. West Jordan City was chosen as being representative of the physical and growth characteristics of the southwest quadrant of Salt Lake County. Economic analysis concluded that the new pressurized irrigation system is not feasible at this time unless the price of high-quality water increases. The cost to retrofit present subdivisions to serve the 1980 population of 30,000 and the future growth of West Jordan (for 50 years) is approximately $11,460,000. An increased water charge per 1/4 acre lot would be about $9.50 per month, or $113 per year. A telephone survey concluded that the few residents on a dual irrigation system are satisfied. (Vernale-Omniplan)
W81-00649

3E. Conservation In Industry

STUDY OF THE POTENTIAL FOR WATER REUSE IN THE STEEL INDUSTRY,
Hydrotechnic Corp. New York.
D. D. Ruggiero, H. Hofstein, A. H. Danzberger, J. T. Chu, and M. Strully.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-122673, Price codes: A05 in paper copy, A01 microfiche. Office of Water Research and Techology Report OWRT/RU-80/2, September 1980. 72 p, 8 Fig, 19 Tab, Append. OWRT-C-80141-R (No 8816)(1), 14-34-0001-8816.

Descriptors: *Water pollution control, *Water conservation, *Water reuse, Water quality *Wastewater treatment, Industrial water, Consumptive use, Water management, Industrial wastes, Steel plant wastewater.

This report presents the results of an engineering study of water use in the steel industry in the United States. Water requirements are presented with respect to quality and quanity for the major production processes in integrated steel plants. Water requirements are presented on a national level for iron and steel production in 1977 and anticipated production for the years 1958 and 2000 under three environmental criteria, i.e., those mandated under PL 96-217 of Best Practicable Technology Currently Available (BPT), Best Available Technology Economically Achievable (BAT) and Zero Discharge of Pollutants. It is shown that, to meet these three criteria, increased recirculation of water within integrated steel plants is necessary and, as a result of this recirculation, the quantities of fresh water required is decreased. To improve effluent quality from that attainable under BPT to that attainable under BAT would result in a 38% reduction in fresh water supply required, and when the quality is further improved to zero pollution, the quantity is reduced by an additional 48%, or a total reduction between BPT and zero pollution of 86%. The report describes how increased water reuse within an integrated steel plant may be accomplished and how geographically proximate industries may utilize each other's wastewaters. In attaining the environmental goals, technological and socio-economic stresses result. Research needs to minimize these are described.
W81-00513

WATER CONSERVATION ON THE UPPER MISSOURI AND MISSISSIPPI RIVERS THROUGH THERMAL STANDARDS MODIFICATIONS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
A. R. Giaquinta, and T. E. Croley, II
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-133704. Price codes: A03 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute. Iowa State University, Ames, Completion Report No ISWRRI-100, September, 1980. 34 p, 7 Fig, 5 Tab, 15 Ref. OWRT-B-061-IA(1), 14-34-0001-8017.

Descriptors: *Water conservation, *Thermal pollution, *Thermal powerplants, *Water quality standards, *Missouri River, *Mississippi River, Mathematical studies, Economics, Economic justification, Economic prediction, Power plants, Heat transfer, Heated water, Water pollution, Water pollution sources, Facilities, Legal aspects, Water temperature.

Twenty existing power plants and other industries and municipalities located along the Missouri and Upper Mississippi River impose thermal loads on the river system. Industrial/municipal sources, due to their low thermal loads relative to power plant head loads, were excluded from this study. All power plants were assumed to operate at 80% capacity factor. Fixed-charged rates of 17.90 and 14.75% were used in the economic analysis of existing and proposed power plants, respectively Computational procedures were used to compute cooling-related costs of power production and water consumption for changing thermal standards. Coding related power production costs for several different hypothetical thermal standards were computed for all existing/proposed plants. These costs were compared and marginal trade-off relationships were computed. The thermal standards considered were the free-discharge and no discharge standards, the existing standards of the States, and several standards given as temperature

decrements for the existing standard. There would be considerably more heat assimilation capacity in the river using the relaxed standards, providing the ability to size larger future 'permissible' plants at specified locations. (Zielinski-IPA)
W81-00695

KRAFT PULP BLEACHING AND RECOVERY PROCESS,
Scott Paper Co., Philadelphia, PA. (Assignee).
For primary bibliographic entry see Field 5D.
W81-00718

PROCESS AND APPARATUS FOR DEWATERING GRANULATED MATERIAL, ESPECIALLY GRANULATED BLAST FURNACE SLAG,
E. Muller-Spath, K. Muller, H. Kister, W. Schurhoff, and F. W. Hillnhutter.
U.S. Patent No 4,196,078, 8 p, 7 Fig, 1 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 243, April 1, 1980.

Descriptors: *Patents, *Waste water treatment, *Water reuse, Industrial wastes, Water purification, Dewatering, Equipment, Filtration, Blast furnace slag.

A process for dewatering granular bulk material, especially blast furnace slag, which is granulated to sand by the injection of water into the liquid slag stream is described. The slag sand-water mixture is fed to a bucket wheel device, the slag sand is dewatered in perforated scoops of the bucket wheel and fed to a continuous conveyor via a hopper, and the water overflowing from a trough of the bucket wheel device which is contaminated by solids, is clarified. The contaminated water is collected in filter chutes and continuously filtered and then fed to a settling tank for reuse. (Sinha - OEIS)
W81-00720

3F. Conservation In Agriculture

INVESTIGATION OF FACTORS AFFECTING ENERGY FOR IRRIGATION PUMPING,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
A. D. Barefoot.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127557, Price codes: A02 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University Technical Completion Report, September, 1980. 10 p, 2 Tab, 8 Ref. OWRT-A-081-OKLA(1), 14-34-0001-8038.

Descriptors: Irrigation water, *Pumping plants, *Pumping tests, Pumps, *Irrigation wells, *Energy loss, *Efficiencies, Water sources, Water wells, Wells, Irrigation systems, Irrigation practices, Water demand, Irrigation efficiency, Energy budget, Energy, Energy dissipation, Irrigation, Pumping, Consumptive use, Optimization.

Operation efficiency was evaluated for 19 irrigation pumping plants covering five counties in Oklahoma. Most were operated using natural gas; a few using electricity. Most of the irrigation pumps tested were found to be operating at fairly high efficiency levels. Average pump efficiency was found to be about 62%. Newly-installed pumps should operate at near 70% efficiency. Average engine efficiency was found to be about 20%. The average overall pumping efficiency of 13.9% could be increased through better design engineering of pumping plant installations. An efficiency of 15% or higher is desirable. Improved matching of engines to pumps and pumps to well conditions would, in the long term, help reduce irrigation energy use. A rigorous maintenance program coupled to careful matching of engine speed to optimum pump speed could assist final bill reductions for irrigation farmers in the short term. An ongoing program of the type conducted under this study would provide Oklahoma irrigation farmers the means needed to determine the conditions for most efficient operation of their pumping plants. (Zielinski-IPA)
W81-00509

DRIP IRRIGATION SYSTEM FOR AGRICULTURE,
L. E. Sample.
U.S. Patent No 4,191,330, 8 p, 5 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 149, March 4, 1980.

Descriptors: *Patents, *Irrigation systems, *Application equipment, Irrigation efficiency, Irrigation practices, Irrigation operation and maintenance, Drip irrigation.

A drip irrigation system comprises water distribution lines extending across a field or similar area for growing crops. The lines are arranged in at least two separate groups, and the lines in each of the groups are interconnected. A source of pressurized, substantially unfiltered water is selectively connected to the lines, and emitters are connected with and spaced along each of the lines for discharging water into the soil. Each emitter has an orifice sized to generally allow foreign material in the unfiltered water to pass through. A water distributor has an inlet portion connected to the water source, and at least two outlet ports each connected to one of the water line groups. A sequencing valve indexes between the first and second ports, and sequencially and individually connected each of the line groups with the water source, whereby surges of water rush through the line to alleviate clogging of the orifices by the foreign material in the water. (Sinha - OEIS)
W81-00538

IRRIGATION PIPE CONTROL SYSTEM,
Colkhi, Inc. San Diego, Ca. (Assignee)
E. F. Jacobi, and M. R. Madden.
U.S. Patent No 4,191,207, 7 p, 5 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 108, March 4, 1980.

Descriptors: *Patents, *Irrigation systems, *Control systems, Lateral conveyance structures, Pipes, Instrumentation, Irrigation efficiency, Lasers, Alignment, Phototransducers.

A laser referenced control system for maintaining sequence and correcting the deflections of a moving irrigation pipe includes a laser positioned on a reference coordinate against which the irrigation program sequence and the motion of the pipe are taken. In typical use the pipe is supported on powered wheeled carriages which move across the irrigated terrain at a predetermined rate and it is these wheeled carriages that are controlled according to the deviation of the end of the pipe relative the laser optical axis. This deviation is measured in a fore and aft plane by a phototransducer array to provide the control inputs to the carriages, the vertical terrain undulations being compensated by way of a laser alignment servosystem. In this manner the vertical changes in pipe alignment are taken out, the only correction being made in the plane of translation. (Sinha - OEIS)
W81-00539

AUTOMATIC WIND BRACE FOR SIDE ROLL IRRIGATION SYSTEM,
L. W. Baker.
U.S. Patent No 4,191,206, 7 p, 5 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 107-108, March 4, 1980.

Descriptors: *Patents, *Irrigation systems, *Irrigation efficiency, Application equipment, Lateral conveyance structures, Winds, Damage, Irrigation operation and maintenance, Braces.

Wheel supported, side roll irrigation systems may extend for one-half mile or more and are moved by a cental, power-driven mover or a number of such movers. When empty, and therefore quite light in weight, winds of even moderate velocity may cause the wheels to roll relative to the mover, in which case the irrigation pipes become twisted or otherwise damaged. This invention provides for an automatic wind brace which includes an elongated brace member mounted pivotally adjacent its inner end on a base member suported by the irrigation system at a location radially outward of the axis of the supporting wheels, and an extensible damper member pivotally interconnecting the base and brace members for delaying movement of the brace member from its retracted inoperative position placed substantially parallel to the irrigation pipeline, to its extended, operative position projecting angularly downward into engagement of its outer end with the ground. (Sinha - OEIS)
W81-00540

WHEEL RUT CLOSING DEVICE FOR IRRIGATION SYSTEM,
Geobel (Ray) and Sons, Inc., Lebanon, SD. (Assignee).
L. W. Goebel.
U.S. Patent No 4,192,388, 5 p, 6 Fig, 18 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 508, March 11, 1980.

Descriptors: *Patents, *Irrigation systems, Application equipment, Operation and maintenance, Irigation efficiency, Wheel ruts.

A new and useful device is used in combination with an irrigation system having an irrigation line, and an irrigation line support or supports mounted on a wheel or a number of wheels, to close a wheel rut or ruts created by the wheel or wheels. The wheel rut closing device is mounted on each irrigation line support and generally comprises an implement support frame mounted on the irrigation line support and extending generally rearward of the wheel. A rearwardly trailing implement holder is pivotally connected to the frame and means are carried by the holder for closing a wheel rut or ruts. The frame and the holder can be raised and lowered to the desired height. (Sinha - OEIS)
W81-00541

ARGICULTURAL IRRIGATION SYSTEM AND COMPONENTS THEREFOR,
CH20, Inc., La Grande, OR. (Assignee).
B. Courtright.
U. S. Patent No 4,192,340, 12 p, 13 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 490, March 11, 1980.

Descriptors: *Patents, *Irrigation systems, *Hydraulic systems, Application equipment, Operation and maintenance, Irrigation efficiency, Booster units.

An agricultural irrigation wheel line is provided having a line translational propulsion unit and also a series of torque assist or torque booster units spaced along the line. All of the units are preferably hydraulically driven by water pressure in the irrigation line itself. The master unit is generally provided a coupling, for the hose to be dragged over the field and coupled to a water-pressure source. Both the master and the booster units are coupled to and driven by line pressure in the wheel line, supplying pressured water for spray equipment carried by the line, advancing the line and torquing the same. Controls are provided the units for regulating the stall-out condition of each unit. The units speed up, slow down, or stall out, automatically in response to an undesired line condition, i.e. deflection or deviation from the essential rectilinear condition desired. The same applies to the booster units coupled to mutually spaced points along the line. (Sinha - OEIS)
W81-00542

GUIDANCE SYSTEM FOR IRRIGATION SPRINKLING APPARATUS,
N. S. Standal.
U.S. Patent No 4,192,335, 15 p, 30 Fig, 17 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 488, March 11, 1980.

Descriptors: *Patents, *Irrigation systems, *Sprinkler irrigation, Application equipment, Hydraulic systems, Operation and maintenance, Irrigation efficiency, Guidance systems, Risers.

A sprinkling apparatus is powered for movement along a row of spaced risers. It is guided along a

path parallel to the risers without any physical guidance being provided in the spaces between them. A coupler engages each successive riser and selectively completes a hydraulic circuit between the riser and the sprinkling apparatus. Mechanical indexing and engagement of the coupler relative to the riser is used as a guide for modifying the direction of movement of the sprinkling apparatus in order to permit engagement of the next successive riser by the coupler. All functions of the sprinkling apparatus are automatically sequenced upon engagement of selected risers. Alternate risers can be skipped. Reversal of the sprinkling apparatus can be achieved by placement of stop mechanisms along the row of risers. (Sinha - OEIS)
W81-00543

HIGH CAPACITY SPRINKLER HEAD WITH IMPROVED BRAKE MECHANISM,
Nelson Irrigation Corp., Walla Walla, WA. (Assignee).
L. P. Meyer.
U.S. Patent No 4,193,548, 8 p, 5 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 802, March 18, 1980.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Irrigation operation and maintenance, Application equipment, Irrigation efficiency.

A step-by-step rotary sprinkler head is comprised of a stationary annular housing assembly, an annular mounting member supported within the upper end portion of the housing for rotational movement about a generally vertically extending axis. The mounting member has three sets of equally spaced holes extending vertically. An annular brake member has a set of equally spaced stub shafts extending vertically which slidably engage within one set of holes. The annular brake member has a downwardly facing annular brake surface which engages a fixed upwardly facing brake surface provided by the housing. A sprinkler body assembly is carried by the mounting member and is fixedly secured by bolts. A series of coil springs is mounted within a third one of the sets of holes to resiliently urge the interengaging brake surfaces together with a constant spring force. (Sinha - OEIS)
W81-00544

FLOW CONTROL VALVE FOR SUBSURFACE IRRIGATION SYSTEM,
S. Riusech.
U.S. Patent No 4,193,711, 4 p, 5 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 956, March 18, 1980.

Descriptors: *Patents, *Irrigation systems, *Subsurface irrigation, Flow control, Application equipment, Irrigation efficiency, Irrigation operation and maintenance, Valves.

The invention provides an improved flow control valve structure for use in a subsurface irrigation system. It is designed to control the water flow characteristics of the system so that generally the water distribution is similar throughout the field in the sense that one portion is not overwatered excessively in relation to other portions of the field. The valve includes a foot with a pair of oppositely facing laterally opening holes. The foot is sized to extend through the hole in the bottom surface of a pipe of the system and has an upstanding leg of flexible material to be received within the pipe in a flexed condition. The leg has a longitudinal passageway to deliver fluid flowing in the pipe to the holes in the foot; to the leg, a flexible tube extension is fitted to extend within the pipe and which is of a preselected length, to present predetermined resistance to the water flow, so that the distribution from the system may be generally equalized by selecting the proper length tube extension. (Sinha - OEIS)
W81-00545

AGRICULTURAL WATER USE AND COSTS IN CALIFORNIA,
California Univ., Berkeley.
A. Highstreet, C. F. Nuckton, and G. L. Horner.
University of California, Giannini Foundation of Economics, Information Series 80-2, Division of Agricultural Sciences Bulletin 1896. July, 1980. 41 p, 1 Fig, 5 Tab, 11 Append.

Descriptors: *California, *Water costs, *Crop production budgets, *Irrigation systems, Agricultural watersheds, Application methods, Regional analysis, Water resources development, Field crops, Surface water, Groundwater, Economic evaluation, Drought tolerace.

Eighty-five percent of water used in California initially goes to agriculture; the remainder to municipalities and industries. Predominant regional crops were determined using the County Agricultural Commissioner's 1975 acreage basis in three categories: field crops, fruits and nuts, and vegetables. Interviews with University of California Cooperative Extension county farm advisors in 1979 were the primary source of information on water sources (ground or surface) and application methods used for each regional crop. Estimated regional irrigation costs for each crop are differentiated by water source, application rate, and irrigation method in 13 production regions of California. Application rates vary from region to region for the same crop due to differences in climate, soil type, and the availability and cost of water. Computer modeling was used to determine crop production budgets. Future changes in water use may be necessitated by competing demands for water, increasing water costs, or diminished water quality or quantity. (Vernale-Omniplan)
W81-00644

AUTOMATIC CONTROL OF THE MOISTURE CONTENT OF THE SOIL,
L. H. Birnbach, and C. A. Birnbach.
U.S. Patent No 4,194,691, 10 p, 10 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 992, No 4, p 1286, March 25, 1980.

Descriptors: *Patents, *Irrigation, *Soil moisture, *Control systems, Moisture content, Water delivery, Irrigation efficiency, Water requirements, Automatic control.

The moisture content of the soil in each of a number of areas is maintained between predetermined wet and dry thresholds by a control having circuits operative in response to detected thresholds through contacts inserted in the soil to effect the opening and closing of a valve in the conduit by which water is delivered to that area. Typically a number of conduits are connected directly or through junctions to a common water supply and where that supply is pump controlled, the control for each conduit includes circuitry that enables a switch in the pump circuit to be closed whenever the valve operated by that control is open. (Sinha - OEIS)
W81-00708

IRRIGATION EMITTER SYSTEM,
E. Schopp.
U.S. Patent No 4,194,695, 4 p, 2 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 992, No 4, p 1287, March 25, 1980.

Descriptors: *Patents, *Irrigation, *Application equipment, Irrigation efficiency, Irrigation operation and maintenance, Emitters, Drip irrigation.

An irrigation emitter system utilizes a tubular adapter member which is formed of non-rigid plastic material. Self-sealing coupling plugs are connected through the wall surfaces of the adapter member to couple liquid from the adapter member to outlet tubes. A pressure reducing mechanisms is formed in the adapter member for enabling the plugs to be coupled directly to the tubes for distribution of the liquid. The invention eliminates the need for utilizing a drip regulator emitter intermediate the distribution hoses and the pressure regulated adapter and uses a relatively simple pressure member enabling self-sealing coupling plugs to interconnect the flexible distribution hose directly to the adapter. (Sinha - OEIS)
W81-00709

SELF-PROPELLED IRRIGATION APPARATUS,
Moulton Irrigation Co., Somerset, WI. (Assignee).
D. C. Scholz.
U.S. Patent No 4,195,781, 12 p, 12 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 150, April 1, 1980.

Descriptors: *Patents, *Irrigation systems, Sprinkler irrigation, Control systems, Irrigation operation and maintenance, Irrigation efficiency, Self-propelled irrigation system.

A self-propelled irrigation apparatus has a main pressurized water distribution pipe with its inner end pivotally supported at a central supply pipe and radially extending distribution pipe sections which have swinging connections with each other. It has a mobile support at the outer end of a section, a water reaction spray motor for driving each mobile support and a diaphragm-operated 'on-off' motor control valve connecting the motor to the distribution pipe. A pilot valve selectively connects a pressure control chamber at one side of the control valve diaphragm with either the pressurized water in the pipe or with a pressure relief opening in response to predetermined relative swinging movement of the pipe sections. The apparatus also has one or more controllable irrigation sprinkler units connected to the distribution pipe by a separate diaphragm operated 'on-off' sprinkler control valve at a location spaced from the reaction motor. The sprinkler control valve has a similar pressure control chamber connected to the same pilot valve for simultaneous 'on' or 'off' control of the reaction motor and sprinkler unit (Sinha - OEIS)
W81-00715

METHOD AND DEVICE FOR ENHANCING THE DISTRIBUTION OF WATER FROM A SPRINKLER OPERATED AT LOW PRESSURES,
Rain Bird Sprinkler Mfg. Corp., Glendora, CA. (Assignee).
E. M. Troup.
U.S. Patent No 4,195,782, 5 p, 3 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 150, April 1, 1980.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Application equipment, Irrigation operation and maintenance, Irrigation efficiency, Nozzles.

A new and improved nozzle and method of operation for use in irrigation sprinklers of the impact and reaction drive types is described. Water may be evenly distributed over the range of the sprinkler even when operating at relatively low supply pressures. This is accomplished generally by a nozzle which separates the stream of water flowing through the sprinkler into at least two separate and distinct streams of water, and directs these distinct streams so that they intersect at a predetermined angle after being ejected from the nozzle. On intersection of the streams, the resultant stream is broken into sufficiently small droplets to provide the desired distribution of water by the sprinkler. (Sinha - OEIS)
W81-00716

THREE LAYER IRRIGATION TUBE AND APPARATUS AND METHOD FOR PRODUCING SAME,
G. Gilead.
U.S. Patent No 4,195,784, 9 p, 16 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 151, April 1, 1980.

Descriptors: *Patents, *Irrigation systems, Water delivery, Irrigation operation and maintenance, Irrigation efficiency, Equipment, *Drip irrigation.

A drip irrigation apparatus comprises a first, second and third layers of sheet material, the layers of material being elongate and arranged so that their side edges lie in confronting and coextensive arrangement. The first, second and third layers are joined to each other at their side edges to define a water supply passage between the first and second

layers and to define a water discharge passage between the second and third layers. The second layer is apertured to provide fluid communication between the water supply passage and the water discharge passage. A method and apparatus for producing the drip irrigation apparatus is also provided. (Sinha-OEIS)
W81-00717

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

A BIBLIOGRAPHY OF STREAM ALTERATION (CHANNELIZATION),
Clemson Univ., SC. Dept. of Entomology and Economic Zoology.
For primary bibliographic entry see Field 10C.
W81-00546

TERRESTRIAL-AQUATIC LINKAGES, COMPONENT INTERACTIONS AND POTENTIAL RESTRICTION OF GROWTH OF THE INTRODUCED AQUATIC WEED MYRIOPHYLLUM SPICATUM L. (WATER MILFOIL) I,
Tennessee Univ., Knoxville.
For primary bibliographic entry see Field 2H.
W81-00687

MEASUREMENT OF WATER FLOW RATE,
Department of Agriculture, Washington, DC. Office of the Secretary. (Assignee).
For primary bibliographic entry see Field 2E.
W81-00714

4B. Groundwater Management

MANAGEMENT OF THE HYDROLOGIC SYSTEM IN AREAS SUBJECT TO COAL MINING ACTIVITIES,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5G.
W81-00502

DETERMINATION OF WATER SATURATION IN SUBSURFACE EARTH FORMATIONS ADJACENT WELL BOREHOLES,
Texaco Inc., White Plains, NY. (Assignee).
H. D. Scott.
U.S. Patent No 4,191,884, 7 p, 6 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 317, March 4, 1980.

Descriptors: *Patents, *Borehole geophysics, Geologic formations, Water sources, Salinity, Gamma rays, Aquifer testing.

Gamma ray spectra of earth formation surrounding a well borehole are obtained by bombarding the formations with neutrons from a pulsed neutron source and detecting the gamma rays resulting from capture of thermalized neutrons in the formation using a germanium gamma ray detector. A measure of the ratio of chlorine to hydrogen is obtained from the detected gamma radiation spectra, and the apparent formation water salinity is determined from the chlorine/hydrogen ratio. The water saturation of the formation is then obtained from the apparent formation water salinity and the true formation water salinity. Compensation is made for the presence of saline water in the borehole fluid and in the cement annulus, as well as for any bound water in the formation. (Sinha - OEIS)
W81-00536

GROUND-WATER HYDROLOGY OF THE DADE CITY AREA, PASCO COUNTY, FLORIDA, WITH EMPHASIS ON THE HYDROLOGIC EFFECTS OF PUMPING FROM THE FLORIDAN AQUIFER,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. H. Tribbals, W. Anderson, and C. P. Laughlin.
Geological Survey Water-Resources Investigations 80-33, 1980. 64 p, 34 Fig, 4 Tab, 38 Ref.

Descriptors: *Groundwater, *Hydrogeology, *Deep-well pumping, *Drawdown, *Florida, Water supply, Aquifer characteristics, Water wells, Well data, Groundwater recharge, Potentiometric level, Transmissivity, Storage coefficient, *Pasco County(FL), *Dade City area(FL), *Floridan aquifer.

The Dade City area, northeast Pasco County, Florida, is an area of about 260 square miles. Of the approximately 32 million gallons per day pumped from the Floridan aquifer in the area in 1975, about 16 million gallons per day were pumped from an area of about 0.25 square miles by a citrus processing plant. There are essentially two producing zones in the Floridan aquifer in the Dade City area. The upper zone is from about 10 feet above to about 150 feet below National Geodetic Vertical Datum of 1929, and the lower zone from about 300 to about 500 feet below NGVD of 1929. There is evidence of hydraulic interconnection of the upper and lower zones of the Floridan aquifer. This appears to be highly significant in terms of the geohydrology of the Floridan aquifer in the area, particularly with regard to its ground-water flow pattern, water quality, and aquifer hydraulic characteristics. In the immediate vicinity of the citrus processing plant, aquifer transmissivity may range from 200,000 to as much as 400,000 feet squared per day. It is probable the Floridan is only semiconfined in the immediate vicinity of the citrus processing plant. High aquifer transmissivity in the area is the reason why there are only a few feet of drawdown of the Floridan's potentiometric level even near the center of the well field. (USGS)
W81-00661

4C. Effects On Water Of Man's Non-Water Activities

LEAST COST DESIGN OF URBAN DRAINAGE SYSTEMS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. Han, P. R. Rao, and M. H. Houck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131104, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No 138, September 1980. 119 p, 24 Fig, 14 Tab, 39 Ref, 2 Append. OWRT A-056-IND(2).

Descriptors: *Urban drainage, Least cost, *Design criteria, *Drainage systems, Detention reservoirs, *Model studies, Hydrologic model, Urban runoff, Storm runoff, Urban hydrology, Storm drains, Storage capacity, Rainfall-runoff relationships, *Cost analysis.

An urban hydrologic model is developed which will give a least cost design for an urban drainage system. Unlike many of such models, the model reported provides for inflow rates estimated by the use of an adequate performing hydrologic model. A simple, readily usable, and theoretically sound model which includes ILLUDAS and a dynamic programming subroutine has been developed. The model is tested by using data from Upper Ross-Ade and Bar Berry Heights watersheds in West Lafayette, Indiana. The model was used to investigate the variation of systems costs with the variation in design parameters and to optimally size the detention storage volume for the least cost of the system. The least cost drainage design model developed in this study is easy to apply, practical to use, and considerable amounts of information may be easily obtained from the model. The model is helpful to engineers in the design of least cost drainage systems and in the choice of design parameters which are traditionally selected by using engineering judgement. (Wiersma-Ind)
W81-00552

OPTIMAL PARAMETER ESTIMATION AND INVESTIGATION OF OBJECTIVE FUNCTIONS OF URBAN RUNOFF MODELS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. Han, and A. R. Rao.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131096, Price codes: A08 in paper copy, A01 in microfiche. Technical Report No. 135, September 1980. 153 p, 25 Fig, 54 Tab, 75 Ref. OWRT A-056-IND(1).

Descriptors: *Urban hydrology, *Urban runoff, *Rainfall-runoff relationships, *Model studies, Hydrologic models, Linear programming, Optimization, Least squares method.

This report deals with improvements of urban hydrologic models. Two areas are considered, namely; the optimal estimation of parameters, and the selection of an objective function to produce the best results. Three urban runoff models, ILLUDAS, SWMM and MINNOUR were studied and results showed that the optimal parameter estimates gave better regeneration and prediction performances than cases where the parameters were arbitrarily specified. Another result was that the complexity of the model structure did not guarantee better performance. Two sets of the objective functions were tested by using the data from the Upper Ross-Ade (West Lafayette, Ind.) and the Oakdale Avenue (Chicago) watersheds. The sum of the squared deviations between the observed and the calculated hydrograph ordinates has been the most frequently used objective function in the past and the results of the present study show that this gives the best overall performance. (Wiersma-Ind)
W81-00553

URBAN RUNOFF POLLUTION AND WATER QUALITY PLANNING,
Rutgers- The State Univ., New Brunswick, NJ. Water Resources Research Inst.
For primary bibliographic entry see Field 5B.
W81-00705

4D. Watershed Protection

EFFECTS OF BANK STABILIZATION ON THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF STREAMS AND SMALL RIVERS: AN ANNOTATED BIBLIOGRAPHY,
Missouri Univ., Kansas City. Dept. of Biology.
D. H. Stern, and M. S. Stern.
Fish and Wildlife Service, Biological Services Program, Report FWS/OBS-80/12, July 1980. 84 p, 213 Ref. 14-16-0009-78-035.

Descriptors: *Bibliographies, *Bank stabilization, *Water quality, Streams, Rivers, Water chemistry, Channels, Erosion, Ecology, Beds, Wildlife, Vegetation, Velocity, Stream improvement, Water temperature.

This annotated bibliography provides a reference source of information on the impacts of bank stabilization on the physical and chemical characteristics of streams and small rivers. The bibliography has 213 references, and is indexed by key subject headings, including the following: bed material, channel configuration, channelization impacts, coastal areas, construction, depth and stage, dissolved substances, ecology, erosion, fauna, flow variability, surface area, surveys, suspended solids, techniques, temperature, vegetation, and velocity. Many of the annotations provide a thorough summary of pertinent information contained in the respective references. (Moore - SRC)
W81-00557

EFFECTS OF BANK STABILIZATION ON THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF STREAMS AND SMALL RIVERS: A SYNTHESIS,
Missouri Univ., Kansas City. Dept. of Biology.
D. H. Stern, and M. S. Stern.
Available from Supt. of Documents, GPO, Washington, DC 20402. Fish and Wildlife Service, Bio-

logical Services Program, Report FWS/OBS-80/11, July 1980. 50 p, 109 Ref. 14-16-0009-78-035.

Descriptors: *Bank stabilization, *Water quality, Streams, Rivers, Water chemistry, Channels, Erosion, Ecology, Beds, Water temperature, Velocity, Stream improvement.

This report is a synthesis of available literature relating the effects of bank stabilization to the physical and chemical characteristics of streams. Depth and stage, water surface area of channel and floodplain, channel configuration, water current velocity, water temperature, suspended solids, bed materials, bedload, dissolvd substances, light transmissivity, and flow variability are discussed. Stream management should be confined to the shortest possible length of stream and employ the least amount of artificiality. (Moore - SRC)
W81-00559

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

BASE PEAK PROFILES OF GAS CHROMATOGRAPHY-MASS SPECTROMETRIC DATA OBTAINED FROM THERMAL DESORPTION OF ACTIVATED CARBONS,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
For primary bibliographic entry see Field 7B.
W81-00569

DETERMINATION OF CHEMICAL OXYGEN DEMAND USING AN OPEN-TUBE METHOD,
Yorkshire Water Authority, Leeds (England). Office of Scientific Services.
For primary bibliographic entry see Field 7B.
W81-00571

AUTOMATED DISTILLATION-SPECTOPHOTOMETRY PROCEDURE FOR DETERMINING AMMONIA IN WATER,
Ontario Ministry of the Environment, Rexdale, Water Quality Branch.
J. Crowther, and J. Evans.
Analyst, Vol 105, No 1254, p 841-848, September, 1980. 3 Fig, 3 Tab, 8 Ref.

Descriptors: *Ammonia, *Surface waters, *Spectrophotometry, *Automation, *Distillation, Nitrogen compounds, Industrial wastes, Separation techniques, Pollutant identification, Hydrogen ion concentration, Temperature, Waste water treatment, Analytical techniques, Color, Water pollution sources, Water analysis, Turbidity.

The automation of the distillation pretreatment procedure for the analysis of ammonia in waste water by spectrophotometry is described. A Technicon AutoAnalyzer was modified for the distillation of ammonia using either a phosphate (pH 7.4) or a borate (pH 9.5) buffer. Ammonia recovery depended on the pH of the distillation but was reproducible for both buffers. Both buffers allowed 95% recoveries of added ammonia from solutions of 55 test compounds. However, the system buffered to pH 9.4 was 1.4 times more sensitive than that buffered to pH 7.4. Less than 0.5% hydrolysis of 24 organic nitrogen contaminants occurred with both of the buffers. Formation of blockages in the distillation coils was encountered in the heating bath, but this was overcome by adjusting the temperature and flow rates to prevent formation of precipitates. The inefficiency of the partitioning of ammonia from the gas-liquid stream mixture into the re-sample stream was overcome by replacing the commercial distillation heads with a gas-liquid separator developed in-house. The effects of distillation temperature, hydrochloric acid concentrations, pH, and interfering pollutants on the system were also examined. Optimum temperature for the heat bath was found to be 112C for flow rates of 0.32-3.40 mL/min. Lead, some volatile organics (e.g., formaldehyde), and some organic nitrogen compounds interfered with the method. The technique was deemed suitable for the analysis of highly colored and/or turbid surface waters with possible application to grossly polluted industrial waste waters with added buffering. (Geiger-FRC)
W81-00576

BLANKING SYSTEM FOR THE SPECTROPHOTOMETRIC DETERMINATION OF AMMONIA IN SURFACE WATERS,
Ontario Ministry of the Environment, Rexdale. Water Quality Branch.
J. Crowther, and J. Evans.
Analyst, Vol 105, No 1254, p 849-854, September, 1980. 2 Fig, 6 Tab, 4 Ref.

Descriptors: *Spectrophotometry, *Ammonia, *Surface waters, *Automation, Analytical techniques, Nitrogen compounds, Laboratory tests, Colorimetry, Color reactions, Pollutant identification, Humic acids, Colbalt, Nitrates, Sulfides, Water analysis, Water Pollution sources.

A blanking system to be used in conjunction with automated spectrophotometry for the determination of low levels of ammonia in surface waters is described. A Technicon AutoAnalyzer was set up with dual flow cells for determinations of ammonia by a variation of the phenate-hypochlorite procedure and was used for analysis of ammonium chloride standards and suface water samples. The reference stream contained an equal flow of water in place of the nitroprusside catalyst that was used in the color-forming stream. The calibration was linear to within 0.001 mg/liter as nitrogen. The mean standard deviation for duplicate analyses of routine samples was 0.0023 mg/liter as nitrogen for ammonia levels $<$ 0.080 mg/liter as nitrogen. Comparisons of results from blanking system analyses and an automated distillation spectrophotometric procedure gave correlations over 99.9%, with values being about 1% lower in the blanking technique. The blanking system experienced interference by high levels of cobalt (II, 2 mg/liter), nitrate (50 mg/liter as nitrogen), sulfide, and tannic and humic acids. These interferences should be taken into account before the blanking system is substituted for the distillation pretreatment step. (Geiger-FRC)
W81-00598

EXCHANGE OF COMMENTS ON SCHEME FOR CLASSIFICATION OF HEAVY METAL SPECIES IN NATURAL WATERS,
Colorado State Univ., Fort Collins. Dept. of Chemistry.
R. K. Skogerboe, S. A. Wilson, J. G. Osteryoung, T. M. Florence, and G. E. Batley.
Analytical Chemistry, Vol 52, No 12, p 1960-1963, October, 1980. 2 Tab, 23 Ref.

Descriptors: *Water analysis, *Heavy metals, *Thermodynamic behavior, *Speciation, Analytical techniques, Chemical analysis, Equilibrium, Chemical reactions, Mercury, Hydrogen ion concentration, Pollutant identification.

The trace metal speciation scheme for heavy metals in natural waters developed by Batley and Florence is discussed. The scheme is based on behavioral differences and identifies four classes of metals. It is suggested that the terms 'labile' and 'nonlabile' produce confusion, because the time lapse between sample treatment and analysis as well as the duration of the analysis itself may affect the ability to discriminate between labile and nonlabile metals. Thermodynamic or kinetic stability can also influence the results. The adjustment of pH can affect the degree of ionization and metal binding, causing a significant shift in relevant complexation equilibria. The addition of acetate can sharply shift metal-ligand equilibria even when the formation constants for the competing ligand systems are considerably higher than those of the metal-acetate systems. Addition of mercury can displace metals form their ligands. It is suggested that such equilibrium shifts and validation models be added to the scheme. In reply to the discussion, Florence and Batley emphasize that, in their scheme, results are operationally defined and do not necessarily reflect true equilibrium concentrations. It should not be assumed that the original equilibrium species concentrations will be obtained if mercury and acetate are omitted and pH is not altered. Florence and Batley are now developing a speciation scheme using a thiol complexing resin which is equilibrated with the sample at the original pH. (Titus-FRC)
W81-00599

ON-COLUMN CRYOGENIC TRAPPING OF SORBED ORGANICS FOR DETERMINATION BY CAPILLARY GAS CHROMATOGRAPHY,
Washington Univ., Seattle Dept. of Environmental Health.
For primary bibliographic entry see Field 7B.
W81-00600

DETERMINATION OF ALPHA-CHLOROACETANILIDES IN WATER BY GAS CHROMATOGRAPHY AND INFRARED SPECTROMETRY,
Monsanto Agricultural Products Co., St. Louis, MO. Research Dept.
For primary bibliographic entry see Field 7B.
W81-00601

INTERLABORATORY COMPARISON OF DETERMINATIONS OF TRACE LEVEL HYDROCARBONS IN MUSSELS,
National Bureau of Standards, Washington, DC. Organic Analytical Research Div.
S. A. Wise, S. N. Chesler, F. R. Guenther, H. S. Hertz, and L. R. Hilpert.
Analytical Chemistry, Vol 52, No 12, p 1828-1833, October, 1980. 1 Fig, 3 Tab, 16 Ref.

Descriptors: *Laboratory tests, *Bioindicators, *Water analysis, Water pollution, Fossil fuels, Gas chromatography, Variability, Oil pollution, Mussels, Monitoring, Analytical techniques, Laboratories, Organic compounds, Sampling.

The current use of mussels as a bioindicator of water pollution by fossil fuel hydrocarbons has necessitated the establishment of baseline data for comparison among laboratories dealing with the monitoring of marine environments by these organisms. Eight laboratories participated in analyses of hydrocarbons in two species of mussels collected from the waters of Simpson Bay, Alaska and from waters affected by natural oil seeps near Santa Barbara, California. Tissue homogenates of Mytilus edulis and Mytilus californianus were analyzed with no prescribed protocol by the laboratories so that results would reflect the variability of currently generated environmental measurements. Seven of the eight laboratories used column chromatography for the separation of trace hydrocarbons while one laboratory used liquid chromatography. All eight laboratories used gas chromatography for hydrocarbon analyses with various internal standards and methods for quantification and identification. Values for levels of total extractable hydrocarbons, total hydrocarbons in the gas chromatographic elution range and individual hydrocarbon compounds generally differed by less than a factor of four. Inhomogeneity of samples, analysis uncertainty and instability of sample storage over a period of nine months all contributed to an observed interlaboratory precision of plus or minus 40%. (Geiger-FRC)
W81-00602

GAS CHROMATOGRAPHIC-MASS SPECTROMETRIC ANALYSIS OF CHLORINATION EFFECTS ON COMMERCIAL COAL-TAR LEACHATE,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
For primary bibliographic entry see Field 7B.
W81-00603

INTRODUCTION (SPECIAL ISSUE ON THE PROGRESS OF AN ON-GOING PROGRAM TO IMPROVE METHODOLOGIES FOR THE ANALYSIS OF PRIORITY POLLUTANTS IN WASTE WATER EFFLUENTS),
Villanova Univ., PA.
For primary bibliographic entry see Field 7B.

W81-00609

ALUMINUM POLLUTION AND FISH TOXICITY,
Clyde River Purification Board, East Kilbride (Scotland).
For primary bibliographic entry see Field 5C.
W81-00619

THE ESTIMATION OF ARSENIC CONCENTRATIONS IN SEWAGE SLUDGES FROM THE LOTHIAN REGION,
Lothian Regional Council, Edinburgh (Scotland). Dept. of Drainage.
J. Webster.
Water Pollution Control, Vol 79, No 3, p 405-412, 1980. 4 Fig, 5 Tab, 10 Ref.

Descriptors: *Sewage sludge, *Chemical analysis, *Arsenic, *Atomic absorption spectrophotometry, Water polllution, Spectrophotometry, Analytical techniques, Industrial wastes, Domestic wastes, Sludge disposal, Sludge digestion, Pollutant identification.

The investigation of a sensitive, rapid, and inexpensive method for the determination of low concentrations of arsenic in sewage sludge is reported. This method uses sludge that has been digested using nitric/perchloric acid being pipetted into the reduction cell followed by the addition of borohydride. The liberated arsine is carried by a stream of nitrogen from the cell to a silica furnace, maintained at dull-red heat by the air-acetylene flame of an atomic absorption spectrophotometer. This procedure was not capable of great precision or accuracy; for sludge carried through the whole procedure the coefficient of variation was from about 50-90%. In view of these difficulties, a more accurate method is certainly required by water pollution laboratories for sludge samples, although this method would probably be suitable for river or sewage effluent samples. (McKeon-FRC)
W81-00621

AN AUTOMATED METHOD FOR THE SIMULTANEOUS DETERMINATION OF NITROGEN AND PHOSPHORUS IN PLANT MATERIAL, SLUDGE AND SOIL,
Water Research Centre, Stevenage (England).
For primary bibliographic entry see Field 7B.
W81-00622

GC/MS IDENTIFICATION OF TRACE ORGANICS IN PHILADELPHIA DRINKING WATERS DURING A 2-YEAR PERIOD,
Drexel Univ., Philadelphia, PA. Dept. of Chemistry.
I. H. Suffet, L. Brenner, and P. R. Cairo.
Water Research, Vol 14, No 7, p 853-867, July, 1980. 4 Fig, 4 Tab, 24 Ref.

Descriptors: *Potable water, *Organic compounds, *Gas chromatography, *Mass spectrometry, Impaired water quality, Separation techniques, Chemistry, Solvent extractions, Water analysis, Pollutant identification, Analytical technqiues, Industrial wastes, Aromatic compounds, Water quality.

This report describes gas chromatography with mass spectrometry (GC/MS) analyses of trace organic constituents found in Philadelphia drinking water from February 1975 to January 1977. Continuous on-line sampling techniques utilizing macroreticular resin and liquid-liquid extractor followed by GC/MS analyses isolated 138 organic compounds, 41 of which are on the EPA revised list of priority pollutants. Isolated compounds fell within five general classes: halogenated aromatic and halogenated aliphatic, other aromatics, other aliphatics, phthalate esters, and miscellaneous. Using computer reconstructed plots of GC profiles, the high variability of these compounds was evident by superimposing plots from successive weeks on top of one another. This high variability of organic compounds with time is indicative of a watershed with numerous industrial discharges. A comparison was made between the results presented in this report with others who have sampled Philadelphia drinking water during this two-year time period. (McKeon-FRC)
W81-00623

COMPARISON OF THE TOXICITY THRESHOLDS OF WATER POLLUTANTS TO BACTERIA, ALGAE, AND PROTOZOA IN THE CELL MULTIPLICATION INHIBITION TEST,
Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden-, und Lufthygiene.
G. Bringmann, and R. Kuhn.
Water Research, Vol 14, No 3, p 231-241, March, 1980. 10 Tab.

Descriptors: *Bioindicators, *Pollutant identification, *Aquatic algae, *Aquatic bacteria, *Protozoa, Toxicity, Environmental effects, Inorganic compounds, Aromatic compounds, Nitrogen compounds, Pseudomonas, Aquatic animals, Alcohols, Water pollution effects, Model studies, Chlorinated hydrocarbon pesticides, Monitoring, Pollutants, Scenedesmus, Self-purification, Aquatic microorganisms, Pesticides, Organic acids, Organic compounds.

In order for an organism to be used as a test organism in studies of water toxicology, its ecological and physiological requirements must be known. In addition, the model organism must provide early indications of potential water pollution that are easily detectable to the toxicologist. Analogous methods of the cell multiplication inhibition test were used to determine the toxicity threshold (TT) of 156 potential water pollutants for model organisms of biological self purification. Various inorganic compounds and organic chemicals including alcohols, aldehydes, ketones, organic acids and their salts, esters, aromatic hydrocarbons, organic nitro-compounds, and organochlorines were tested on a model bacterium, algae, and protozoa. Of the 156 inorganic and organic pollutants tested, 23 exhibited a pronounced selective toxicity to bacteria, Pseudomonas putida, 46 to algae, Scenedesmus quadricauda, and 43 to flagellate protozoa, Entosiphon sulcatum. It was concluded that determination of TT of potential water pollutants for three rather than one model organism from the microbiological spectrum would give a broader basis for assessing the environmental effects of water pollutants. (Geiger-FRC)
W81-00628

METHODS FOR DETECTION OF VIRUS IN WASTEWATER, APPLIED TO SAMPLES FROM SMALL SCALE TREATMENT SYSTEMS,
Royal Veterinary and Agriculture Coll., Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
B. Lydholm, and A. L. Nielsen.
Water Research, Vol 14, No 2, p 169-173, February, 1980. 2 Tab, 15 Ref.

Descriptors: *Waste water treatment, *Viruses, *Pollutant identification, Domestic wastes, Sewage, Disinfection, Chemical precipitation, Heat treatment, Sewage treatment.

The effect of two small scale wastewater treatment systems on indigenous viruses in effluent from an emscher tank system serving a school in Denmark was examined. The emscher tank treatd a mixture of outlets from toilet, bath and kitchen. Viruses were consistently found from all three sources. At a pasteurization plant where outlets from toilets were treated by formaldehyde and heating to 76C for 30 minutes, a few samples from the influent were positive but no viruses were detected in the effluent. Four different methods of detecting viruses in wastewater were compared. Alum precipitation and acidic precipitation gave various degrees of virus detection depending on the amount of precipitate. With a two-phase separation technique, the lowest detectable virus concentration was 0.05 TCID50/ml of wastewater. When direct inoculation was used, none of the samples tested suggested the presence of viruses in blind passages. No differences were found in the efficiency of viral detection between the precipitation of two-phase concentration methods. The wastewater treatment operations of the pasteurization plant examined in this study seemed adequate for control of harmful viruses. (Geiger-FRC)
W81-00631

VARIABLE SOURCES OF SUSPENDED SEDIMENT AND NUTRIENTS FROM SMALL WATERSHEDS,
Max C. Fleischmann Coll. of Agriculture, Reno, NV.
M. H. Lohrey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-132425, Price codes: A04 in paper copy, A01 in michrofiche. Water Resources Center, University of Nevada, Publication No 43006, 1977. 62 p, 3 Fig, 1 Tab, 29 Ref, 4 Append. OWRT-A-072-NEV(1), 14-31-0001-6029.

Descriptors: *Sediment transport, *Sediment yield, *Nutrients, *Small watersheds, Watersheds(Basins), Chemical properties, Water quality, Streamflow, Channel morphology, Path of pollutants, *Nevada.

A stream channel classification procedure was developed to delineate and characterize the channel networks of watersheds in terms of factors affecting production of fluvial sediment and nutrients. The procedure was applied to 10 small watersheds in the east-central Sierra Nevada where yield of suspended sediment and nutrients (notably nitrate nitrogen, organic nitrogen, and orthophosphate) had been measured during the snowmelt period. The relationship and significance of these channel characteristics to the yield of the above parameters was tested with multiple regression techniques. Although the classification procedure was shown to be significant, length of ephemeral channels and flow proved to be the most important variables to the production of suspended sediment and nitrate nitrogen. However, channel characteristics did not prove to have a significant effect on production of organic nitrogen and orthophosphate. Predictive equations were developed for susepended sediment and nitrate nitrogen, but because of the limited number of observations (10), more research is necessary before the equations can be successfully utilized by the land.
W81-00638

WATER QUALITY OF TAMPA BAY, FLORIDA: JUNE 1972 - MAY 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. L. Goetz, and C. R. Goodwin.
Geological Survey Water-Resources Investigations 80-12, 1980. 49 p, 36 Fig, 4 Tab, 24 Ref.

Descriptors: *Water quality, *Bays, *Florida, *Chemical properties, Nutrients, Metals, Physical properties, Sampling, Sites, Data collections, *Tampa Bay(FL).

A comprehensive assessment of the water quality of Tampa Bay, Florida, was initiated in 1970 to provide background information to evaluate the effects of widening and deepening the ship channel to the port of Tampa. This report provides results of water-quality sampling in the bay from 1972 to 1976, prior to dredging. Measurements of temperature, dissolved oxygen, pH, turbidity, specific conductance, biochemical oxygen demand, and total organic carbon were made as well as measurements for several nutrient, metal, and pesticide parameters. Many parameters were measured at as many as three points in the vertical. These data indicate that Tampa Bay is well-mixed vertically with little density stratification. Time histories of average temperature, dissolved oxygen, pH, turbidity, specific conductance and nutrient values within four subareas of Tampa Bay are given to reveal seasonal or other trends during the period of record. Temperature, dissolved oxygen, pH, turbidity, specific conductance, nutrient, biochemical oxygen demand, total organic carbon, and metal data are also presented as areal distributions. Nutrient concentrations were generally higher in Hillsborough Bay than in other sub-areas of Tampa Bay. Biochemical oxygen demand, total organic carbon, and total organic nitrogen distribution patterns show regions of highest concentrations to be

along bay shorelines near population centers. Of the metals analyzed, all were present in concentrations of less than 1 milligram per liter. (USGS)
W81-00662

CONDENSED REPORT ON THE USE OF ENZYMATIC CYCLING FOR HIGH SPECIFICITY AND PRECISION IN THE COLORIMETRIC ANALYSIS OF AMMONIA,
American Univ., Washington, DC. Dept. of Chemistry.
F. W. Carson, and H. W. Davies.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137937, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of the District of Columbia, Washington, DC. Final Report, October 1980. 30 p, 2 Fig, 44 Ref. OWRT-B-009-DC(2), 14-34-0001-807.

Descriptors: *Ammonia, *Ammonium compounds, *Enzymes, *Analytical techniques, *Assay, Chemical analysis, Testing procedures, Nitrogen compounds, Organic compounds, Catalysts, Biochemistry, Colorimetry, Spectrophotometry, Instrumentation, Laboratory test, Nutrients, Inorganic compounds, Nutrient removal, Measurement, Water measurement, Evaluation, Testing, Water pollution.

A new method is reported for the colorimetric determination of ammonia in water, based on enzymatic cycling using the ammonia-specific glutamate dehydrogenase reaction followed by an enzymatic cycling reaction that provided controlled amplification of the response to ammonium ion. The cycling reaction product (a tetrazolium formazan) had a conveniently-measured visible absorption maximum at 600 nm. With the established procedure, absorbance versus original ammonium ion concentration plots were linear (correlation coefficients: 0.997-0.9998). The new method was simple and precise in the range of 0.0001-0.00001 molar ammonia concentrations. The sensitivity could be extended well below the ten nanomole per sample determination limit of the assay procedure described, using suitable modifications of the procedure. The coefficient of variation was 2% for a series of replicate measurements on samples containing 0.0000441 molar ammonium ion. A calibration curve for the determination of unknown concentrations could be constructed by carrying standard solutions through the procedure. The method only required the use of volumetric equipment and a spectrophotometer or colorimeter. Analysis time per sample was three hours, and all solutions could be prepared in advance and used for at least two weeks. (Zielinski-IPA)
W81-00698

EUTROPHICATION IN PEEL INLET-I. THE PROBLEM-DEFINING BEHAVIOR AND A MATHEMATICAL MODEL FOR THE PHOSPHORUS SCENARIO,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
G. M. Hornberger, and R. C. Spear.
Water Research, Vol 14, No 1, p 29-42, January, 1980. 6 Fig, 1 Tab, 51 Ref.

Descriptors: *Eutrophication, *Model studies, *Phosphorus, *Inlets, *Cladophora, Nutrients, Connate water, Nitrogen, Theoretical analysis, Simulation analysis, Monte Carlo method, Nuisance algae, Phytoplankton, Sediments, Photosynthesis, Biomass, Australia, Mathematical models, Computer models, Statistical methods, Peel Inlet.

To attack the problems of excessive algal growth in Peel Inlet, Western Australia, a simulated model assuming phosphorus to be the causitive element was examined. The alga in question was Cladophora aff. battersii. The factors which in reality have caused excessive algal growth are still uncertain, but it was hoped that a simulation model specifying a priori statistical distributions based on data from other euthrophied water systems would provide information or suggest new hypotheses during experimentation. A Monte Carlo approach was used for the model, which consisted of four compartments: Cladophora, phytoplankton, soluble phosphorus in the water column, and sediment (layer of decomposing material underlying much of the photosynthesizing Cladophora mat). Parameters considered included temperature-light growth coefficient, loss rate, and half-saturation content for Cladophora and phytoplankton, Cladophora maximum photosynthesis biomass, sediment-water diffusion and maximum sediment concentration, Cladophora and phytoplankton loss to sediment, groundwater concentration, tidal exchange efficiency parameter, and river sediment-phosphorus coefficient. A total of 626 simulation tests were done using the phosphorus scenario, and results indicate that this approach was amenable to the study of eutrophication by algae at the inlet. The feasibility of applying a nitrogen scenario to this particular problem is still being investigated. (Geiger-FRC)
W81-00725

THE USE OF HYDROBIA JENKINSI TO DETECT INTERMITTENT TOXIC DISCHARGES TO A RIVER,
Plymouth Polytechnic (England). Dept. of Environmental Sciences.
L. Brown.
Water Research, Vol 14, No 8, p 941-947, August, 1980. 1 Fig, 5 Tab, 15 Ref.

Descriptors: *Bioassay, *Dieldrin, *Heavy metals, *Gastropods, *Bioindicators, Chlorinated hydrocarbon pesticides, Chromium, Copper, Rivers, Toxicity, On-site tests, Laboratory tests, Water pollution sources, Industrial wastes, Textiles, River Holme, *England.

River pollution in the Holme, Yorkshire, England and its tributaries was monitored from October 1975 to October 1977 using an in situ bioassay with the operculate gastropod Hydrobia jenkinsi. Effluents containing toxic textile axcillary chemicals such as pesticides like dieldrin and heavy metals (copper and trivalent and hexavalent chromium) are discharged into the Holme. River samples artificially spiked with dieldrin or heavy metals were used in laboratory tests to assess survival rates of the gastropod to known levels of toxins. Close correlations were noted between laboratory toxicity test responses and those found when H. jenkinsi was exposed to polluted river water samples. When caged H. jenkinsi were exposed in situ to water from pollutant discharge sites along the waterways, gastropod responses made it possible to detect when discharges were contaminated with certain heavy metals, especially copper and hexavalent chromium. In situ death was not due solely to dieldrin or heavy metals. At levels in excess of 30,000 nanograms/liter, dieldrin failed to produce a toxic response in H. jenkinsi, suggesting the need for an organism susceptible to pesticides as an indicator for river pollution by this organochlorine compound. (Geiger-FRC)
W81-00745

SENSORY PROPERTIES AND ANALYSIS OF TWO MUDDY ODOUR COMPOUNDS, GEOSMIN AND 2-METHYLISOBORNEOL, IN WATER AND FISH,
Helsinki Univ. (Finland). Dept. of Limnology.
P. Persson.
Water Research, Vol 14, No 8, p 1113-1118, August, 1980. 4 Fig, 2 Tab, 49 Ref.

Descriptors: *Water quality, *Fish, *Odor, *Actinomycetes, Soil microorganisms, Organoleptic properties, Impaired water quality, Cyanophyta, Potable water, Rainbow trout, Pikes.

The sensory properties of geosmin and 2-methylisoborneol (MIB) in water and in the flesh of four species of fish were studied. Threshold odor concentrations indicate that both compounds have strong odor characteristics. Sensory panels were able to discriminate between geosmin and MIB down to 0.05 ppb. The sensitivity of the human nose still exceeds the sensitivity of chemical methods used for the analysis of these muddy odor compounds. The perceived intensities of geosmin and MIB by the sensory panels were proportional to the logarithm of the concentration of muddy odor compounds in the concentration ranges tested (for geosmin, up to 100 ppb, and for MIB, up to 10 ppb). The quantification of muddy odor compounds in water and fish by sensory methods may be possible, according to the results presented. (McKeon-FRC)
W81-00748

THE STABILITY OF BOVINE PARVOVIRUS AND ITS POSSIBLE USE AS AN INDICATOR FOR THE PERSISTENCE OF ENTERIC VIRUSES,
Royal Veterinary and Agriculture Coll., Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
R. N. Srivastava, and E. Lund.
Water Research, Vol 14, No 8, p 1017-1021, August, 1980. 3 Tab, 14 Ref.

Descriptors: *Viruses, *Farm wastes, *Waste disposal, *Cultures, Public health, Human diseases, Wastes, Microbiology, Organic wastes, Domestic animals.

The suitability of the bovine parvovirus 1 (Haden virus) for use as an indicator of bovine enteric viruses was studied; the rates of its inactivation in liquid manure are reported. Calf kidney cell cultures, 0-24 hr old, were suitable for parvovirus studies and demonstrated a pronounced cytopathic effect. The virus' rate of inactivation (time in min for a 1 log unit reduction in titer) at 60, 70, and 80C was 360, 72, and 16 min. When the virus was seeded in liquid manure it became inactivated at a rate of around 6-8 days for 1 log unit under aerobic conditions at 5-20C. Inactivation under anaerobic conditions was highly temperature dependent: at 5C it took 188 days to decrease the titer 1 log unit, but at 20C it took only 20 days to reduce the titer 1 log unit. It is suggested that these parvoviruses may also be useful as indicators for human enteric viruses, e.g., infectious hepatitis virus. (McKeon-FRC)
W81-00749

5B. Sources Of Pollution

REMOVAL OF TRACE METALS FROM SEDIMENTS UNDER CHEMICO-OSMOTIC GRADIENTS,
Rhode Island Univ., Kingston.
V. A. Nacci.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127409, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, 1980, 33 p, 9 Fig, 2 Tab, 14 Ref. OWRT-A-070-RI(1), 14-0001-34-0142.

Descriptors: *Trace metals, *Sediments, *Self purification, *Ion transport, *Diffusion, Soils, Clay minerals, Water pollution, Geophysics, Heavy metals, Chemical reactions, Pore water, Porosity, Flow.

The investigation of the process in which a sediment will depollute itself under a chemico-osmotic gradient is presented in regards to both a theoretical and experimental approach. A system was designed utilizing electrical conductivity methods to determine the time rate of the diffusional process. This was in turn compared to theory based on irreversible thermodynamics and Terzaghi's theory on consolidation. The diffusivity measured through means outlined in this study was then shown to be reflective of the sediment properties. Once the diffusivity had been measured it was possible to obtain a 'time estimate' for depolluting these sediments.
W81-00504

CHLORINATED PARAFFINS AND THE ENVIRONMENT. 1. ENVIRONMENTAL OCCURRENCE,
Imperial Chemical Industries Ltd., Runcorn (England). Mond Div.
I. Campbell, and G. McConnell.
Environmental Science and Technology, Vol 14, No 10, p 1209-1214, October, 1980. 3 Fig, 6 Tab, 4 Ref.

Descriptors: *Pollutants, *Chlorinated paraffins, *Water pollution, Sediments, Aquatic life, Pikes, Mussels, Water birds, Food chains, Fish, Benthos, Path of pollutants, Water quality, Bird eggs, Foods.

The aim of this study was to measure the distribution and persistence of chlorinated paraffins (CP) in the environment, to determine their pathways through the environment, and to measure their concentrations in animal and vegetable life. Because CP are involatile, their transport by moving water is probably the only large-scale dispersion mechanism available to the product. However, half the waters studied (industrialized waterways and marine and fresh water remote from industry) showed C10-20 CP at 0.5-4 0 ppb, and less than half showed C20-30 CP at 0.5-2.0 ppb. CPs were seen in only a few sediments, at up to 0.5 ppm. C20-30 CP was almost absent from aquatic organisms, and C10-20 CP was present only at low levels. The median concentration distribution in seabirds' eggs was 0.2 ppm of C10-20 CP; C20-30 CP was almost absent. Mean CP levels in dairy/oil foods were higher (0.15-0.3 ppm) than in fruit/vegetables and beverages (0-0.025 ppm). Low levels of CP were detected in at least one human tissue from every subject tested. The total body burden of CP was estimated to be in the range 0-7 mg with an average of 2.3 mg. This quantity is not expected to pose a health hazard to man. There was no indication of biomagnification in any food chain, aquatic or on land, including the human food chain. (See also W81-00578) (McKeon-FRC)
W81-00577

INTERLABORATORY COMPARISON OF DETERMINATIONS OF TRACE LEVEL HYDROCARBONS IN MUSSELS,
National Bureau of Standards, Washington, DC. Organic Analytical Research Div.
For primary bibliographic entry see Field 5A.
W81-00602

243,244-CM IN COLUMBIA RIVER SEDIMENTS,
Oregon State Univ., Newport. Marine Science Center.
T. M. Beasley, and L. A. Ball.
Nature (London), Vol 287, No 5783, p 624-625, 16 October, 1980. 1 Tab, 8 Ref.

Descriptors: *Reservoirs, *Nuclear wastes, *Cores, *Columbia River, Lichens, Sediments, Water pollution sources, Movement, Mass spectrometry, Radioactive wastes, Sampling, Soil erosion, Radioisotopes, Fallout, Deposition(Sediments), Sediment transport.

Data derived from a sediment core sample taken from McNary reservoir in Washington State in August 1977 have shown the presence of 244-Cm in lichens as a result of the testing of nuclear devices. McNary reservoir lies about 100 km downstream from the Hanford Reservation in Washington State and contains accumulations of sedimentary materials transported by the Columbia River. Samples taken from the reservoir prior to 1961 were not analyzed for curium isotope production which could have occurred during nuclear testing from 1952 to 1958. Analyses for 239,240-Pu and 241-Am in Columbia River sediments demonstratd that activity resulting from testing was 1 to 3% that of 239,240-Pu. Mass spectrometry results have indicated that 25% of the 239,240-Pu radioactivity in McNary reservoir was derived from plutonium reactors on the Hanford Reservation. However, it was concluded that the 243,244-Cm found in this study was derived entirely from fallout. It was suggested that erosion processes on the land have mobilized and concentrated material containing radioactive curium in the river where they were subsequently sedimented. (Geiger-FRC)
W81-00611

PERSISTENCE OF 12 INSECTICIDES IN WATER,
Malaysian Agricultural Research and Development Inst., Selangor.
M. S. Sharom, J. R. W. Miles, C. R. Harris, and F. L. McEwen.
Water Research, Vol 14, No 8, p 1089-1093, August, 1980. 4 Fig, 1 Tab, 24 Ref.

Descriptors: *Persistence, *Microbial degradation, *Insecticides, *Pesticide kinetics, Path of pollutants, Aquatic microorganisms, Chlorinated hydrocarbon pesticides, Organophosphorus pesticides, Carbamate pesticides, Natural streams, Biodegradation, Water pollution sources, Pesticides, DDT, Dieldrin, Diazinon, Chemical degradation.

The persistence of 12 insecticides representing organochlorine, organophosphorus, and carbamate compounds was measured in distilled and natural water to evaluate the role of microbial degradation of insecticides in the aquatic environment. Four types of water were used: natural, distilled, sterlized natural, and sterilized distilled. Concentrations of insecticides used were 5 ppm for carbaryl, carbofuran, chlorphrifos, diazinon, ethion, leptophos, and parathion, 10 ppm for mevinphos, and 0.1 ppm for DDT. Rapid disappearance was observed for DDT, lindane, and parathion in natural water, but these same compounds were persistent in the other liquids, indicating the importance of microorganisms in their degradation. Little evidence of chemical decomposition of organochlorine insecticides was observed. Dieldrin, endrin, ethion and leptophos were the most stable compounds in water. In general, the other organophosphorus compounds and the carbamate insecticides were degraded in all four aqueous test systems, indicating the importance of chemical factors in their decomposition. Biological processes played a secondary role in the degradation of chlorphyrifos, diazinon, and carbaryl. After 8 wk in natural waters, dieldrin was the most persistent and parathion the least peristent of all the compounds tested. No evidence was found of persistnce based on chemical structure of the insecticides. (Geiger-FRC)
W81-00625

RVRFLO: A HYDRAULIC SIMULATOR OF WATER QUALITY IN THE HOUSATONIC RIVER IN CONNECTICUT,
Connecticut Agricultural Experiment Station, New Haven.
D. E. Aylor, and C. R. Frink.
Bulletin 780, April 1980. 53 p, 30 Fig, 8 Tab, 48 Ref, 2 Append.

Descriptors: *Connecticut, *Water quality, *River flow, Rivers, *Hydraulic similitude, *Simulaltion analysis, Phosphorus, Chlorine, Polychorinated biphenyls, Nitrogen, Impoundments, Water pollution control, Water pollution sources, Advection, Computer models, *Housatonic River(CT).

The Housatonic River has long received pollutants from municipal and industrial discharges, as well as runoff from forests and fields. The author's goal was to develop a computer simulation model to predict seasonal losses or gains of nutrients or other pollutants in the river. The results suggest strategies for controlling some of the pollutants, such as scaling down tertiary treatment operations, reducing water quality monitoring stations for more efficiency, and limiting phosphorus inputs during certain seasons. The model appears to provide reliable predictions of conservative elements, such as chlorine, and to provide a means of calculating the attenuation of non-conservative elements such as phosphorus and nitrogen. The model, called RVRFLO, is based on the physical principles of hydraulics and uses measurements of water velocity, temperature, and solute concentration at selected sites on th river as well as weekly mean flow and concentration data for major tributaries. The model accounts directly for three major processes governing the change in concentration of conservative chemicals in rivers: (1) advection or horizontal transport; (2) addition of chemicals by tributaries; and (3) dispersion of chemicals. RVRFLO is written in Fortran. (Garrison-Omniplan)
W81-00651

ANALYSIS OF STREAM QUALITY IN THE YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
D. A. Wentz, and T. D. Steele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-108904, Price codes: A08 in paper copy, A01 in microfiche. Geolgical Survey Water-Resources Investigations 80-8, April 1980. 161 p, 80 Fig, 17 Tab, 59 Ref.

Descriptors: *Water quality, *Streamflow, *Hydrologic data, *Statistical methods, *Water temperature, Regional analysis, Low flow, Water chemistry, Sampling, Sites, Chemical analysis, Trace elements, Bottom sediments, Distribution patterns, Data collections, Computer programs, Time series analysis, Colorado, Wyoming, *Yampa River basin(CO-WY), Harmonic analysis.

Historic data show no significant water-temperature changes since 1951 for the Little Snake or Yampa Rivers, the two major streams of the Yampa River basin in Colorado and Wyoming. Regional analyses indicate that harmonic-mean temperature is negatively correlated with altitude. No change in specific conductance since 1951 was noted for the Little Snake River; however, specific conductance in the Yampa River has increaed 14% since that time and is attributed to increased agricultural and municipal use of water. Site-specific relationships between major inorganic constituents and specific conductance for the Little Snake and Yampa Rivers were similar to regional relationships developed from both historic and recent (1975) data. These relationships provide a means for estimating concentrations of major inorganic constituents from specific conductance, which is easily measured. Trace-element and nutrient data collected from August 1975 through September 1976 at 92 sites in the Yampa River basin indicate that water-quality degradation occurred upstream from 3 sites. The degradation resulted from underground drainage from pyritic materials that probably are associated with coal at one site, discharge from powerplant cooling-tower blowdown water at a second site, and runoff from a small watershed containing a gas field at the third site. Ambient concentrations of dissolved and total iron and manganese frequently exceeded proposed Colorado water-quality standards. The concentrations of many dissolved and total trace elements and nutrients were greatest during March 1976. These were associated with larger suspended-sediment concentrations and smaller pH values than at other times of the year. (USGS)
W81-00660

DISSOLVED-SOLIDS CONCENTRATIONS AND LOADS IN RETURN FLOWS TO THE COLORADO RIVER FROM AGRICULTURAL LAND IN SOUTHERN CALIFORNIA,
Geological Survey, Tacoma, WA. Water Resources Div.
J. M. Klein, and W. L. Bradford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-105652, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-52, July, 1980. 54 p, 11 Fig, 3 Tab, 18 Ref.

Descriptors: *Dissolved solids, *Return flow, *Water quality, *Colorado River, *California, Hydrogeology, Salinity, Irrigation water, Chemical analysis, Specific conductivity, Data collections, *Palo Verde Valley(CA), *Fort Mojave area(CA), *Bard Valley(CA).

The dissolved-solids concentration in Colorado River water increases from less than 50 mg/L (milligrams per liter) at the rivers's origin to about 700 mg/L at the California border and to about 900 mg/L at the United States-Mexico boundary. Much of the latter increase is due to depletion by agricultural use and irrigation return water with salts leached from soils under cultivation. Forty sites in three agricultural areas--Fort Mojave, Bard Valley, and Palo Verde Valley--were sampled to describe the dissolved-solids concentrations in return flows. Emphasis was on Palo Verde Valley. In the Fort Mojave area, the dissolved-solids concentration of Colorado River water was about 700 mg/L, while the concentration in water at the tile-drain convergence averaged about 2,500 mg/L. In

the closed sump that presently receives all irrigation return, concentrations ranged from 812 to 1,760 mg/L. In Bard Valley, water diverted from the river had an annual mean dissolved-solids concentration of about 835 mg/L. During the study, concentrations in two main drains carrying irrigation return water ranged from 953 to 1,290 mg/L. Selected drains in Palo Verde Valley were sampled several times to determine dissolved solids loads from subareas within the valley. Loads determined in this study were compared with those of an earlier study. In agreement with the earlier study, loads were found to be largest from three subareas in the southern half of the valley and comparatively small from the four subareas in the northern half. Smaller loads were found in this study from all subareas, however. The differences are thought to be due to generally lower water discharge observed in drains during this study. (USGS)
W81-00664

WATER QUALITY ASPECTS OF COAL TRANSPORTATION BY SLURRY PIPELINE,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
J. W. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142127, Price codes: A15 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, University of Arkansas, Project Completion Report, August, 1980. 325 p, 326 Fig, 24 Tab, 8 Ref. OWRT-B-0505-ARK(1), 14-34-0001-6058.

Descriptors: *Coals, *Pipelines, *Water quality, Water use, *Hydraulic transportation, *Slurries, Hydraulic conduits, Hydraulic structures, Pipes, Transportation, Structures, Trace elements, Waste water(Pollution), Alkalinity, Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, Sulfates, Sodium, Hardness(Water), Nitrates, Silica, Conductivity.

Twenty-four batch reactors were designed and constructed for operation in two 12-gang stirring units, equipped with nitrogen purging above the slurry for anaerobic studies (when desired). The research program was designed to: (1) identify and characterize water quality changes during movement of western coal by slurry pipeline; (2) determine feasibility for using impaired quality water (such as municipal/industrial effluents) as slurry medium; and (3) determine tratment measures for restoring water quality of the slurry waste water if needed. Water input quality was varied and four slurry loadings (30, 40, 50, and 60% solids) were used to determine effects of slurry solids concentrations on water quality. Water quality parameters measured included alkalinity, BOD, COD, trace elements, dissolved solids, nitrate, sulfate, pH, silica, specific conductance, and total hardness, dissolved solids, sulfate and sodium would result from slurry pipelining for the western coals studied, with lower concentrations of Al, Pb, Ti, chloride, and nitrate to be expected in slurry waste water. Concentrations of Cr, Cu, Fe, Mn, Hg, Zn and phosphate were not detected. Slurry water quality changes occurred as a function of coal and water sources used. (Zielinski-IPA)
W81-00673

IN-SITU EVALUATION OF THE FILTERING FUNCTION OF A PIEDMONT CREEK SWAMP,
Georgia State Univ., Atlanta. Dept. of Chemistry.
C. H. Wharton, and H. P. Hopkins, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142234, Price codes: A04 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology, Atlanta, Report ERC 02-80, April, 1980. 46 p, 20 Fig, 1 Tab, 13 Ref. OWRT-A-071-GA(1).

Descriptors: *Water quality, *Swamps. *Filtration, *Cycling nutrients, Water flow, Georgia, *Trace elements, Analytical techniques, Aquatic habitats, Wetlands, Wastes, Nutrients, Nutrient removal, Waste assimilative capacity, Research and Development, Metals, Iron, Magnesium, Manganese, Sodium, Zinc, Aluminum, Water pollution sources, Phosphorous, Phosphates, Nitrogen, Ammonia.

A small northern piedmont region swamp in Georgia was monitored for two years, starting in September, 1976, to determine whether swamps might serve as sinks for nutrients and trace metals. Total amounts of phosphorus (orthoposphate, hyrolyzable phosphate, and total phosphate), nitrates, ammonia, and several trace metals (Fe, Mg, Mn, Na, An, Al) flowing into and out of the Cornish Creek Swamp were monitored over the two-year period. The swamp had been formed when a portion of the channellized Cornish Creek was filled up with sand and debris. Since the entrance/exit for the swamp was well-defined, the total amount of water moving through thhe swamp could be established. This information, combined with chemical analysis, allowed calculation of the total amount of chemical nutrients and metal passing through the swamp over the two-year study. Phosphorous, nitrogen and trace metals levels indicated the swamp waters to be pristine. During the majority of study months, total phosphate had a small reduction, and nitrate increased, after the water flowed through the swamp. Large quantities of ammonia left the swamp during Spring. Abnormally high zinc levels reached the swamp from an unknown source, but the swamp effectively reduced the zinc level in the stream. (Zielinski-IPA)
W81-00677

URBAN RUNOFF POLLUTION AND WATER QUALITY PLANNING,
Rutgers- The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr.
Journal of the Technical Councils of the American Society of Civil Engineers, Vol 106, No TC1, Proceedings Paper 15632, p 101-115, August 1980. 7 Fig, 3 Tab, 14 Ref, 1 Append. OWRT A-046-NJ(5) A-048-NJ(8), 14-34-0001-8032, 14-34-0001-9032.

Descriptors: *Water quality, *Urban runoff, *Planning, *Sampling, Sediments, Bed load, Biochemical oxygen demand, Nutrients, Heavy metals, Oil, Storms, Storm runoff, Hydrographs, Flood control, Pollutants, Path of pollutants, Water pollution, Water pollution sources, Streams, Environmental engineering, Hydrology.

Areawide Water Quality Planning under Section 208 of PL 92-500 is supposed to integrate two approaches, first, effluent treatment requirements, and, two, the achieving of stated water quality criteria with control of nonpoint as well as of point sources of pollution. Urban runoff pollution is considered one of the nonpoint sources, although it flows largely through storm and combined sewers. Section 208 planning has been handicapped for lack of adequate data and technology applicable to the highly variable storm flows that characterize urban runoff. Urban runoff pollution includes sediment, BOD, nutrients, heavy metals, and petroleum, most of which occur in particulate form. It is harmful to fish life, but the agents mainly reponsible are usually not identified. Planning of remedial measures requires consideration of both steady state and variable flow modeling. Detention storage for combined purposes of flood control and water quality appears to have some possibilities. (Sims-ISWS)
W81-00705

EUTROPHICATION IN PEEL INLET-II. IDENTIFICATION OF CRITICAL UNCERTAINTIES VIA GENERALIZED SENSITIVITY ANALYSIS,
California Univ., Berkeley. Dept. of Biomedical and Environmental Health Sciences.
R. C. Spear, and G. M. Hornberger.
Water Research, Vol 14, No 1, p 43-49, January, 1980. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Eutrophication, *Model studies, *Inlets, *Phosphorus, *Cladophora, Nutrients, Connate water, Sediments, Sediment transport, Deposition, Future planning(Projected), Theoretical analysis, Nuisance algae, Phytoplankton, Mathematical studies, Simulation analysis, Australia.

In this follow-up study based on a phosphorus model of cultural eutrophication processes in Peel Inlet, Western Australia, a generalized sensitivity analysis is outlined. The purpose of the analysis was to identify critical uncertainties in the present knowledge of the Peel Inlet system to direct the planning of future research. Results suggested that the nuisance algae Cladophora aff. battersii had access to nutrients from interstitial water in the sediments of the Inlet and from riverborne sediment deposits. From these findings, a recommendation was made to quantify the river input of sediment-bound nutrients as the next area of research and to establish to what extent these nutrients occur in sediments where Cladophora are most prominent. It was also suggested that further in-depth studies be made on Cladophora physiology. (Geiger-FRC)
W81-00726

PSEUDOMONAS AERUGINOSA AND ESCHERICHIA COLI IN SEWAGE AND FRESH WATER,
Dundee Univ. (Scotland). Dept. of Civil Engineering.
D. W. F. Wheater, D. D. Mara, L. Jawad, and J. Oragui.
Water Research, Vol 14, No 7, p 713-721, July, 1980. 3 Fig, 6 Tab, 22 Ref.

Descriptors: *E. coli, *Pseudomonas, *Domestic wastes, *Natural streams, *Sewage, Enteric bacteria, Sewage bacteria, Sewage treatment, Hospitals, Path of pollutants, Water treatment, Water pollution, Water pollution treatment, Freshwater, Rivers, Water pollution sources.

The incidence of Pseudomonas aeruginosa was evaluated along with E. coli as an indicator of fecal pollution in sewage effluent from domestic and hospital sources. P. aeruginosa was consistently found in domestic and hospital sewage at levels usually less than 300,000/100 ml and 500,000/100 ml, respectively. E. coli/P. aeruginosa ratios were normally less than 25 for hospital sewage and over 500 for ordinary domestic sewage. Both bacteria were reduced in number by about 90% after passage of the domestic or hospital effluents through sewage treatment plants, so that after treatment, the E. coli/P. aeruginosa ratios resembled those in the corresponding raw sewage. Calculations of both bacteria were also made from Dighty freshwater stream water and from human and animal fecal specimens. In the freshwater stream samples, P. aeruginosa numbers reflected levels of domestic wastes. Counts of E. coli and P. aeruginosa over the length of the Dighty were similar, except in agricultural areas, where P. aeruginosa was not detected even when E. coli counts were high. These findings were in agreement with results from fecal analysis showing the presence of P. aeruginosa in human samples and the lack of significant numbers of this organism in animal fecal samples. (Geiger-FRC)
W81-00736

THE MUTAGENIC ACTIVITY IN A SECTION OF THE SHEEP RIVER, ALBERTA RECEIVING A CHLORINATED SEWAGE EFFLUENT,
Calgary Univ. (Alberta). Div. of Pathology.
R. L. Moore, L. L. Osborne, and R. W. Davies.
Water Research, Vol 14, No 7, p 917-920, July, 1980. 3 Fig, 3 Tab, 18 Ref.

Descriptors: *Chlorination, *Mutagens, *Invertebrates, *Sewage effluents, Toxicity, Rivers, Suspended solids, Volatility, Environmental effects, Sewage treatment, Municipal wastes, Benthic fauna.

Studies were conducted to determine if increased mutagenic activity in the water, suspended particulate matter, and benthic macroinvertebrate populations in the Sheep River of Alberta was the result of chlorinated sewage discharge from the Turner Valley municipal sewage treatment plant. Sewage at the facility undergoes secondary treatment followed by chlorination before discharge into the river water. A gas refinery also discharges into the river near the sewage plant. Samples taken from six stations along the river were analyzed for muta-

genicity by the Ames-Salmonella/mammalian microsome mutagenicity test. Total residual chlorine levels at the time of sampling were also determined. Low levels of mutagenic activity were found in water and benthic macroinvertebrate samples, especially from sites where the chlorinated effluents were discharged. Evidence was also found of bioconcentration of chlorine throughout the benthic macroinvertebrate food chain. Due to the extreme volatility of some of the chlorinated compounds, little or no mutagenic activity on the particulate matter would be expected, as was observed. (Geiger-FRC)
W81-00737

MERCURY CONCENTRATIONS IN FISH INHABITING TWO POLLUTED LAKES IN NORTHERN CANADA,
Alberta Environmental Centre, Vegreville.
J. W. Moore, and D. J. Sutherland.
Water Research, Vol 14, No 7, p 903-907, July, 1980. 1 Fig, 1 Tab, 18 Ref.

Descriptors: *Mercury, *Sediments, *Fish, Trout, Pikes, Industrial wastes, Pollutant identification, Water quality, Water pollution, *Lakes, *Canada.

During 1978 and 1977 concentrations of total mercury were determined in the sediments, water and fish of Giauque Lake and Thompson Lake in northern Canada. Mercury laden industrial discharges had previously been permitted to flow into the lakes. In Giauque Lake the trout contained an average of 3.68 mg/kg mercury in their muscle tissue, while average concentrations in northern pike and round whitefish were 1.75 and 1.22 mg/kg, respectively. Mercury levels greater than 500 micrograms/kg were found on about 7% of the lake bottom. In water, the mercury concentrations were below detectable limits, 0.2 microgram/liter. Mercury levels in Thompson Lake northern pike averaged 1.69 mg/kg; in whitefish the highest value was 0.6 mg/kg. Heavy concentrations of mercury in the sediments reached 1300 micrograms/kg. Almost 15% of the lake bottom contained mercury in excess of 500 microgram/kg. It was concluded that northern pike are still accumulating mercury from exposed tailings which were deposited in Thompson Lake about 30 yr ago. It was also concluded that the contamination of only a small part of a lake can result in high pollutant levels in fish throughout the entire lake. (Baker-FRC)
W81-00742

5C. Effects Of Pollution

CONCORDANCE OF HEAVY METAL AND ANTIBIOTIC RESISTANCE ON PLASMIDS OF CHESAPEAKE BAY BACTERIA,
Maryland Univ., College Park. Water Resources Research Center.
L. A. McNicol.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127532, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 58, October 1980. 74 p, 7 Fig, 21 Tab, 70 Ref. OWRT-A-048-MD(1), 14-34-0001-9022.

Descriptors: Pollutants, *Water pollution effects, *Chesapeake Bay, *Antibiotics(Pesticides), *Aquatic bacteria, *Heavy metals, *Bioassay, Epidemiology, Toxicity, Water pollution, Bodies of water, Organic compounds, Bactericides, Bacteria, Microorganisms, Bioindicators, Metals, Water pollution sources, Chemical wastes, Lead, Nickel, Cadmium, Mercury, Pollutant identification.

Antibiotic-resistant and heavy metal-resident phenotypic frequency was measured in Chesapeake Bay bacterial strains obtained from Bay sites differing significantly in water quality. The phenotypes were estimated from dose-response curves using direct plating, replica plating, and minimal inhibitory concentration (MIC). Resistant and sensitive organisms could be distinguished by concentrations of twenty micrograms per milliliter for various antibiotics (amphicillin, chloramphenicol, nalidixic acid, penicillin, streptomycin, and tetracycline), and of 0.05 millimolar for the heavy metals tested (cadmium, mercury, nickel, and lead). Individual resistance phenotypes of 1816 isolates were determined with the replica technique, with 85% resistant to at least one antibiotic and a surprising 2% resistant to all six drugs tested. Occurrence of resistant organisms did not correlate with water quality, sampling location, season, sample type, or physical parameters of the site. Ninety-two percent of organisms examined were resistant to at least one metal studied, with 43% resistant to all metals, but resistance did not correlate with any station or sample parameters. Metal and drug resistant phenotypes did correlate positively with one another, but these two traits were not appreciably linked on plasmid DNA. (Zielinski-IPA)
W81-00508

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF: KODIAK INTERIM SYNTHESIS REPORT -- 1980.
Science Applications, Inc., Boulder, CO.
National Oceanic and Atmospheric Administration Report, March 1980. 326 p, 167 Fig, 76 Tab, 565 Ref.

Descriptors: *Alaska, *Environmental effects, *Energy, *Natural gas, *Continental shelf, Leases, Exploitation, Arctic, Subarctic, Geographical regions, Pacific coast region, Regions, Cold regions, Legal aspects, Marine geology, Aquatic life, Water quality, Economic impact, Pollutants, Water pollution, Fisheries.

The Bureau of Land Management requested the National Oceanic and Atmospheric Administration to conduct the Outer Shelf Environmental Assessment Program (OCSEAP), covering several lease areas on the Alaskan Outer Continental Shelf (OCS) from the subarctic Northeast Gulf of Alaska to the arctic Beaufort Sea. Extensive environmental studies must be conducted before OCS area development can safely proceed on oil and gas deposits. The continental shelf east of the Kodiak Archipelago had been selected for exploration and development of such deposits (OCS Sale 46). If economic gas recovery is possible, petroleum development off Kodiak would include a liquified natural gas plant ashore and extensive gas plant transport lines from offshore wells. The Archipelago and adjacent shelf waters have high biological activity, endangered species, with the coastline highly vulnerable to oil spill damage. Probable ecological impacts were noted for such plant development. OCSEAP studies in Kodiak resulted in an extensive data base on marine environment biology, chemistry, geology, microbiology, physics, and in interdisciplinary workshops. Four major environmental issues were identified for the studies program: impact on commerical fisheries; geological hazards; contaminant transport; protection of regional biota and important habitants. The lease sale date was planned for December 1980. (Zielinski-IPA)
W81-00512

ANTHROPOGENIC INFLUENCE OF THE SEDIMENTARY REGIME OF AN URBAN ESTUARY - BOSTON HARBOR,
Woods Hole Oceanographic Insitution, MA. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2L.
W81-00519

IMPACTS OF URANIUM MINING AND MILLING UPON THE FISH AND WILDLIFE RESOURCES OF THE NEW MEXICO SAN JUAN BASIN REGION,
New Mexico State Univer., Las Cruces. Dept. of Fishery and Wildlife Sciences.
S. C. Meneely, S. L. Duzan, and S. D. Schemnitz.
Available from Supt. of Documents, GPO, Washington, DC 20402. Fish and Wildlife Service, Biological Services Program, Report FWS/OBS-80/56, September 1980. 171 p, 7 Fig, 20 Tab, 235 Ref, 6 Append. 14-16-0002-77-906.

Descriptors: *Mine wastes, *Radioactive wastes, *Uranium radioisotopes, *Wildlife, *Fish, Mills, Mine water, Vegetation, Indian reservations, New Mexico, Arizona, Colorado, Widllife habitats, Water pollution.

Fish and wildlife species and their habitats within the San Juan Basin of New Mexico, Arizona and Colorado on Indian lands are identified. Field inventories were taken on existing and proposed uranium development sites during the summer of 1979 to determine the distribution of wildlife species. The inventories indicate species migration and emigration associated with this type of mining activity. Potential impacts that may be realized if different stages of uranium mining and milling are conducted were identified, based on development projections from the Bureau of Indian Affairs. Some species benefited as a result of water impoundments, in the water discharge and fencing to restrict grazing activity from the site. Direct impacts of uranium mining and milling include habitat alteration, contamination of aquifers and contamination by radionnuclides and toxic elements from uranium mill ponds and trailing piles. (Moore-SRC)
W81-00555

RESPONSES OF SUBMERSED VASCULAR PLANT COMMUNITIES TO ENVIRONMENTAL CHANGE: SUMMARY,
East Carolina Univ., Greenville, NC. Dept. of Biology.
G. J. Davis, and M. M. Brinson.
Available from Supt. of Documents, GPO, Washington, DC 20402. Fish and Wildlife Service, Biological Services Program, Report FWS/OBS-80/42, August 1980. 19 p, 1 Tab, 7 Ref. 14-16-0009-78-032.

Descriptors: *Aquatic plants, *Turbidity, *Sedimentation, *Plant growth, Aquatic environment, Water levels, Waves(Water), Seasonal, Nutrients, Submerged plants, Rooted aquatic plants, Eutrophication, Light intensity.

Since many land and water development projects have the potential of altering the environment of aquatic vascular plants, it is essential to unsdertand how aquatic plant species respond to changing physical, chemical, and biological conditions. Factors that affect the growth of submersed, rooted, aquatic macrophytes are reviewed, including: light transmission, fluctuating water levels, wave action, sedimentation, nutrients, and seasonal effects. Groups of macrophyte species are listed according to resistance to ecosystem change, and examples of human activities which may adversely affect natural systems and the possible effects on submerged plant populations are given in a table. (Moore - SRC)
W81-00556

STRATEGY FOR ASSESSING IMPACTS OF POWER PLANTS ON FISH AND SHELLFISH POPULATIONS,
National Power Plant Team, Ann Arbor, MI.
For primary bibliographic entry see Field 6B.
W81-00563

POTENTIAL IMPACTS OF LOW PH ON FISH AND FISH POPULATIONS,
National Power Plant Team, Ann Arbor, MI.
E. S. Fritz.
Available from Supt. of Documents, GPO, Washington, DC 20402, Report FWS/OBS-80/40.2, October 1980. 17 p, 3 Tab, 45 Ref.

Descriptors: *Fish physiology, *Toxicity, *Acidity, Environmental effects, Fish populations, Fish reproduction, Fish diseases, Predation, Acidic waters, Habitats, Fish genetics.

One of the most alarming impacts associated with increasing acidification of surface waters, and acid precipitation is the decline and extinction of fish populations and assemblages in lakes and streams. The effects of low pH on fish are reviewed. The toxic effects of low pH are found to differ among species, populations, and age-groups of the same species. Field studies show that the toxicity of low pH is compounded by other water characteristics. Low pH could increase susceptibility to disease,

impair osmoregulation and ionregulation, inhibit hormone production or activity, result in genetic damage, change predator-prey relationships, degrade habitat, and increase the availability of toxic substances. Low pH can result in reproductive failure on the population level, recruitment failure, and on the individual level, cessation of spawning. Slight declines in productivity as they relate to stressed populations, have the potential to result in unrecoverable drops in population density. (Moore - SRC)
W81-00564

CHLORINATED PARAFFINS AND THE ENVIRONMENT. 2. AQUATIC AND AVIAN TOXICOLOGY,
Imperial Chemical Industries Ltd., Runcorn (England). Mond Div.
J. R. Madeley, and R. D. N. Birtley.
Environmental Science and Technology, Vol 14, No 10, 1215-1221, October, 1980. 1 Fig, 7 Tab, 15 Ref.

Descriptors: *Toxicity, *Chlorinated paraffins, *Path of pollutants, *Water pollution sources, Diets, Rainbow trout, Water birds, Mussels, Bioassay, Fish behavior, Biochemical oxygen demand, Anaerobic digestion, Microorganisms, Biodegradation, Pollutants, Fish.

The results of laboratory studies on toxicity, bioaccumulation, and biodegradation of chlorinated paraffins (CP) in the aquatic environment are presented; some information on avian and mammalian toxicity is also given. Short-term toxicity tests (96 hr) demonstrate the very low acute toxicity of CP to rainbow trout and bluegills. During more prolonged exposure, neurotoxic symptoms appeared when lower molecular weight compounds were tested. The level of CP in the body tissues of mussels was always less than that adsorbed on food particles filtered from the water. This uptake was reversed on substitution of 'clean' diets, and the CP appeared to be expelled from the animal in its original form. Rainbow trout appeared to metabolize CP. Up to 80% of assimilated C14 from C14-labeled CP in tissues was not recognizable as CP after 13 days. Microorganisms previously acclimated to specific forms of CP showed a greater ability to degrade the compounds than organisms normally treating domestic sewage. Increasing chlorination percentage inhibited biodegradation. Short-chain compounds were most readily oxidized at chlorine levels below 60%. Complete breakdown of long-chain CP was observed over a period of 8 Wk. Anaerobic microorganisms did not degrade a specific CP in 30 days. Cereclor S52 was of low subacute toxicity when fed to ring-necked pheasants and mallard ducks. In two predictive in vitro tests, three grades of CP showed no mutagenic potential. (See also W81-00577) (McKeon-FRC)
W81-00578

EFFECTS OF NUTRIENTS ON ALGAL GROWTH IN WATERS OF THE CANBERRA REGION AND RELATED CONTROL MEASURES,
Department of Housing and Construction, Phillip (Australia).
D. A. Henley, D. C. Keiller, and A. L. Downing.
Water Pollution Control, Vol 79, No 2, p 195-212, 1980. 12 Fig, 6 Tab, 21 Ref.

Descriptors: *Sewage treatment, *Water quality, *Algal control, *Nutrients, Nitrogen, Phosphorus, Mathematical models, Algae, Rivers, Waste water treatment, Water pollution, Water pollution control, Water resources planning, Sewage effluents, Lakes, Treatment facilities.

The effects of phosphorus and nitrogen in sewage effluent on algal growth in the rivers and lakes surrounding the Lower Molonglo Water Quality Control Centre, near Canberra, Australia were studied in order to guide operation of the plant. A river water quality model was developed that related water quality in rivers to their flow, to inputs of pollution from land and from sewage, and to the influences of 'self-purification' in the rivers. The model predicted that the removal of nitrogen and phosphorus at the plant would almost certainly produce a massive improvement in the quality of lake waters. Removal of nitrogen alone would probably bring about a similar, less marked, result. In neither case would the chance of major algal blooms be completely eliminated. Removal of phosphorus alone would be expected to bring about a major improvement in quality provided that all Canberra's sewage were treated, and the maximum phosphorus removal possible at the plant were consistently achieved. Removing phosphorus alone for as much time as possible would be of major economic benefit. At the time of writing, the plant had not brought denitrification tanks into use, and with limited phosphorus removal, little, if any, improvement in algal growth could be seen. This is not inconsistent with the conclusion that phosphorus removal to the full extent of plant capabilities will be required to achieve significant improvement. A discussion follows this article. (McKeon-FRC)
W81-00586

AGRICULTURAL AREA IMPACTS WITHIN A NATURAL AREA: CADES COVE, A CASE HISTORY,
Great Smoky Mountains National Park, Gatlinburg, TN. Uplands Field Research Lab.
S. P. Bratton, R. C. Mathews, and P. S. White.
Environmental Management, Vol 4, No 5, p 433-448, September, 1980. 11 Fig, 4 Tab, 33 Ref.

Descriptors: *Water pollution, *Nutrients, *Agricultural runoff, *Coliforms, Hay, Water temperature, Turbidity, Phosphorus compounds, Nitrogen, Ammonia, Water quality, Aquatic bacteria, National Parks, Tennessee, Pollutant identification, Benthic fauna, Fish, Vegetation, Wildlife.

Agricultrual management in Cades Cove, an historic district in Great Smoky Mountains National Park, has affected natural resources both within the district and in the adjoining natural areas. A program of hay and cattle production begun in 1967 brought about a number of changes in the terrestrial flora and fauna and in the aquatic systems. Changes in the aquatic system included siltation and an increase in nutrient loading. Water temperatures in the stressed area were increased as were turbidity and nutrient (PO4 and NO3) loads. The number of taxa represented in the benthos community in the stressed area of Cades Cove was also lower than in other stations monitored above and below the Cove. Coliform counts in the Cove were frequently in the 100s (per 100 ml) and occasionally in the 1,000. The fecal steptococcus to fecal coliform ratios indicated that animals rather than human sources were responsible. The fecal coliform levels were often higher than the State of Tennessee standards for primary contact (swimming: desirable level $< \text{or} = 200$) and were sometimes higher than secondary contact standards (desirable level $< \text{or} = 1{,}000$). The actions taken to date, including fencing cattle out of stream beds and reduction of herd size, has already had a restorative effect on the Cove. The effect of the agricultural management of Cades Cove on wildlife populations and vegetations is also discussed. (McKeon-FRC)
W81-00612

ALUMINUM POLLUTION AND FISH TOXICITY,
Clyde River Purification Board, East Kilbride (Scotland).
J. B. Hunter, S. L. Ross, and J. Tannahill.
Water Pollution Control, Vol 79, No 3, p 413-420, 1980. 3 Fig, 9 Tab, 9 Ref.

Descriptors: *Water pollution sources, *Fishkill, *Aluminum, Bioassay, Brown trout, Effluents, Pollutant identification, Sewage sludge, Hydrogen ion concentration, Waste Disposal, Toxins, Industrial wastes, Water treatment, Photosynthesis, Laboratory tests.

The chemistry, toxicity, and pathology of aluminum (Al) was studied in relation to stream pollution from an anodizing plant. Al was implicated in the sporadic occurrence of fish kills (brown trout) during 1974 and 1975 in the stretch of the Black Cart Water between Howwood and Kilbarchan, Scotland. The acute toxicity of Al was found to depend on the pH of the river water. In laboratory tests using tap water at neutral pH, Al was not acutely toxic even at concentrations of 200 mg/liter. However, at a concentration of 50 mg Al/liter, there was a 40% mortality in 96 hr at pH 8.0 and a 100% mortality in 42 hr at pH 8.5 and 9.0. In addition to the Al from the anodizing plant, a water treatment plant puts an additonal load of Al of up to 1.3 mg/liter on the stream to give a total of up to 3.7 mg/liter of Al downstream from the factories discharge point. It appears that the fish kills were due to the Al concentration in association with an increase in river pH, but whether this increase was caused by the anodizing effluent or photosyntheses is not certain. It is suggested that the maximum concentration of aluminum in the stretch of the river be limited to 0.5 mg/liter. (McKeon-FRC)
W81-00619

EFFECTS OF URBAN RUNOFF AND TREATED MUNICIPAL WASTEWATER ON A MAN-MADE CHANNEL IN NORTHEASTERN ILLINOIS,
Metropolitan Sanitary District of Greater Chicago, Roselle, IL.
I. Polls, C. Lue-Hing, D. R. Zenz, and S. J. Sedita.
Water Research, Vol. 14, No 3, p 207-215, March, 1980. 7 Fig, 6 Tab, 17 Ref.

Descriptors: *Water quality, *Benthic fauna, *Channels, *Sewage effluents, *Storm runoff, Bottom sampling, Chicago River, Water pollution sources, Sewage treatment, Isopods, Oligochaetes, Aquatic animals, Water pollution, Sewers, Diptera, Water analysis, Urban runoff, Municipal wastes.

Monthly samples were collected to monitor the composition of benthic macroinvertebrates and water quality at five sites along the North Shore Channel in Illinois from January to November of 1973. Entering the channel 5.4 km above its junction with the North Branch of the Chicago River are secondary treated effluents of the Northside Sewage Treatment Plant. During storms, sewer overflows add to the channel above and below the treatment plant discharge. Results were compared to a biological survey conducted by the U.S. Public Health Service in 1961. The most important change occuring in the benthic faunal composition downstream from the plant outfall was the presence in 1973 samples of large numbers of isopods and midges, suggesting improved water quality. The 1973 results also indicated that water quality was markedly affected by both urban runoff and a point source effluent from the Northside Sewage Treatment Plant. Compared to upstream values, levels of ammonium nitrogen, nitrite-nitrate nitrogen, total phosphorus, dissolved solids and conductivity in downstream channel waters were increased ($p < 0.05$). The benthic macroinvertebrate composition above and below the treatment plant outfall was characteristic of that found in organically enriched rivers. Samples from the five locations consisted of 89% pollution-tolerant oligochaetes, 7.4% chironomids, 3.5% isopods, and 0.1% leeches. Populations of macroinvertebrates were found to be elevated at all sample points below the treatment plant outfall compared to upstream populations. Macroinvertebrate numbers collected over the 11-month period averaged 9,360/sq m above the outfall and 128,550/sq m for areas 5.3 km below the outfall. (Geiger-FRC)
W81-00626

GROWTH RESPONSES OF SELECTED FRESHWATER ALGAE TO TRACE ELEMENTS AND SCRUBBER ASH SLURRY GENERATED BY COAL-FIRED POWER PLANTS,
Ames Lab., IA.
R. W. Vocke, K. L. Sears, J. J. O'Toole, and R. B. Wildman.
Water Research, Vol 14, No 2, p 141-150, February, 1980. 8 Tab, 67 Ref.

Descriptors: *Aquatic algae, *Toxicity, *Coal mine wastes, *Trace elements, Fly ash, Arsenic compounds, Mercury, Cadmium, Slurries, Scenedesmus, Laboratory tests, Water pollution control, Bioindicators, Environmental effects, Path of pollutants, Heavy metals, Growth rates.

The toxicity of trace elements arsenic (As), cadmium (Cd), mercury (Hg), and Selenium (Se) from coal-fired power plants and scrubber ash slurry extract (SASE) to the freshwater algae Ankistrodesmus falcatus, Scenedesmus obliquus, Selenastrum capricornutum, and Microlcoleus vaginatus were investigated in growth response laboratory tests. Algae were exposed to solutions of Na2HAsO4.7H2O, CdSO4, HgSO4, and Na2SeO4, and SASE from a western U.S. coal-fired power plant complex in a modified version of the EPA Algal Assay Procedure Bottle Test. Levels of trace pollutants in mg/liter in the growth response experiments ranged from 0.01-100.0 for As, 0.001-0.30 for Cd, 0.001-1.0 for Hg, and 0.01-50.0 for Se. SASE was tested at levels of 0.01-100%. A chemical analysis of SASE was made, and regression equations of algal responses to selected trace elements or SASE treatment levels were calculated. Median effective concentration values for the algae tested ranged from 0.048-30.761 mg/liter for As, 0.005-0.019 mg/liter for Cd, 0.33-0.253 mg/liter for Hg, 0.033-8.511 mg/liter for Se, and 3.048-15.417% for SASE. As was significantly inhibitory to the growth of Ankistrodesmus and Scenedesmus at 0.1 and 0.01 mg/liter, respectively, while Selenastrum growth was inhibited significanlty at 25 mg/liter As. Significant growth inhibition occurred in Selenastrum at 0.05 mg/liter Cd, and in the other three species at 0.01 mg/liter Cd. The first significant inhibition of growth of Ankistrodesmus, Scenedesmus, Selenastrum, and Microcoleus occurred at 0.05, 0.1, 0.01, and 0.4 mg/liter Hg, respectively and at 0.01, 0.1, 0.3 and 10 mg/liter Se, respectively. Significant growth inhibition to the four species in the above order was observed with exposure to 1, 5, 10 and 5% concentrations of SASE, respectively. (Geiger-FRC)
W81-00629

THE EFFECTS OF HARDNESS, ALKALINITY AND PH OF TEST WATER ON THE TOXICITY OF COPPER TO RAINBOW TROUT (SALMO GAIRDNERI),
Alberta Univ., Edmonton. Dept. of Zoology.
T. G. Miller, and W. C. Mackay.
Water Research, Vol 14, No 2, p 129-133, February, 1980. 2 Fig, 2 Tab, 34 Ref.

Descriptors: *Hydrogen ion concentration, *Copper, *Alkalinity, *Hardness(Water), *Rainbow trout, *Toxicity, Laboratory tests, Calcium compounds, Heavy metals, Lethal limits, Acidity, Chemical analysis, Spectrophotometry, Water quality, Water analysis, Potable water.

The relative effects of water hardness, alkalinity, and pH on the toxicity of copper to fingerling rainbow trout were investigated in laboratory tests. Fish were kept in test chambers under three separate combinations of alkalinity and hardness in experiments that took 9 months to complete. Variations in alkalinity were accomplished by changing the levels of bicarbonates in the initial dilution of the deionized water. The incipient lethal concentration of copper which caused 50% mortality (ILC50) was determined initially and at the end of the 9-month period. No difference was found in the ILC50 values measured before and after the experiment. Copper was found to be less potent in dechlorinated tapwater than in artificial freshwater ($p < 0.05$). The interaction of copper and acid was found to be antagonistic at pH values of 4.7 or less. A synergistic effect between acid and copper was observed at a pH of 5.4 which caused an ILC50 at copper levels equivalent to 22 micrograms/liter (47% of the control value at pH 7.2). Calcium hardness of the test water was more important than alkalinity in reducing the toxicity of copper. At a hardness of 12 mg/liter, increasing the alkalinity from 10 to 50 mg/liter had no effect on ILC50. When an alkalinity of 10 mg/liter was combined with an increase in hardness from 12 to 100 milligrams/liter, the ILC50 value was increased threefold. However, an antagonistic effect on copper toxicity was noted at a water hardness of 100 mg/liter when the alkalinity was increased. (Geiger-FRC)
W81-00633

PRELIMINARY OBSERVATIONS ON THE BENTHIC MACROINVERTEBRATE COMMUNITIES OF ROSS BAY, A POLLUTED AREA OF LOUGH LEANE, SOUTH-WEST IRELAND,
University Coll., Dublin (Ireland). Dept. of Zoology.
E. J. Wise, and A. O'Sullivan.
Water Research, Vol 14, No 1, p 1-13, January, 1980. 4 Fig, 4 Tab, 41 Ref.

Descriptors: *Lakes, *Benthos, *Water pollution, *Nutrients, *Sewage effluents, Phosphorus, Nitrogen, Ammonia, Chlorophyll, Algae, Biomass, Invertebrates, Biochemical oxygen demand, Dissolved oxygen, Suspended solids, Eutrophication, Detergents, Ireland, Ross Bay.

An attempt was made to quantify the effects of sewage effluent on the density distribution of benthic macroinvertebrates in the stony littoral zone of Ross Bay, Lough Leane, Ireland. The Lough is undergoing accelerated cultural eutrophication mainly due to the discharge of untreated human sewage and domestic detergents. Dissolved oxygen levels were satisfactory over the whole of Ross Bay with the exception of the station closest to the sewage outfall (Station 1), where oxygen depletion was observed (< 30% saturation). BOD levels were consistently low (range 0.8-4.7) except at Station 1 where a value of 5.8 was received. Nitrogen and phosphorus compounds showed a significant negative correlation with distance from the sewage outfall ($p < 0.05$). Chlorophyll a levels reached a peak at Stations 3-5 (mildly polluted) as a result of interaction between nutrient availability and the toxic effects of sewage loading. A relatively low total biomass (12.5 g/m) was found at Station 1 (septic/degradation zone), while organic enrichment promoted a maximum value (4,750 g/m) at Station 2 (moderately polluted). Biomass values decreased through Station 7 (fairly clean). A Biotic Quality Index was devised to allow for the use of information revealed by the species composition of a community. This index is only directly applicable to the lake system for which it was devised, but it can be used for any future assessment of the area. (McKeon-FRC)
W81-00634

THE EFFECT OF SAN FRANCISCO'S WASTEWATER PLAN ON WATER QUALITY AND AQUATIC BIOLOGY,
California Univ., Los Angeles.
For primary bibliographic entry see Field 5F.
W81-00647

THE EVOLUTION OF THALLUS FORM AND SURVIVAL STRATEGIES IN BENTHIC MARINE MACROALGAE: FIELD AND LABORATORY TESTS OF A FUNCTIONAL FORM MODEL,
California Univ., Irvine. Dept. of Ecology and Evolutionary Biology.
M. M. Littler, and D. S. Littler.
The American Naturalist, Vol 116, No 1, p 25-44, July, 1980, 4 Fig, 3 Tab, (California Water Resources Center Project UCAL-WRC-W-491). OWRT-A-054-CAL(13).

Descriptors: *Marine algae, *Benthos, *Biological communities, *Ecology, Plant morphology, Algae, Evolution, Laboratory tests, Synthesis, On-site investigations.

Morphological attributes of algae have long been considered primarily from the standpoint of taxonomy and used to discover new species or to speculate on phylogenetic affinities. While these approaches are of value, a fresh outlook that synthesizes the adaptational significance of algal structure, ecology, and physiology is needed. The present research explores the general concept that morphology, ecological attributes, and productivity are interrelated and synthesizes the adaptive significance of thallus form relative to the productivity ecology and survival of benthis macroalgae. (Snyder-Calif)
W81-00706

SOURCES OF VARIABILITY IN MACROALGAL PRIMARY PRODUCTIVITY: SAMPLING AND INTERPRETATIVE PROBLEMS,
California Univ., Irvine. Dept. of Ecology and Evolutionary Biology.
M. M. Littler, and K. E. Arnold.
Aquatic Botany, Vol 8, p 141-156, 1980. 4 Fig, 1 Tab, 42 Ref, (California Water Resources Center Project UCAL-WRC-W-491). OWRT-A-054-CAL(14).

Descriptors: *Marine algae, *Primary productivity, *Aquatic algae, Sampling, Data collections, Variability, Growth rates, Environmental effects, Respiration, Plant physiology, Reproduction.

Previous macroalgal production studies have been plagued by broad ranges of variability within experimental replicates that often exceed the seasonal or other parameters under investigation. As a first step toward understanding the factors responsible, eight rocky intertidal and subtidal macroalgae were examined for intrinsic sources of variation in photosynthetic performance and respiration relative to season, age, thallus part, reproductive state, external morphology, crowding, macrohabitat, microhabitat, desiccation, and physical injury. An understanding of variations such as those documented in this study is necessary for accurate analyses of macroalgal energetics and for the development of predictive insights into evolutionary strategies of carbon allocation. Therefore, much of the previous research on marine macroalgal productivity should be re-assessed in view of difficulties arising from environmental and intrinsic sources of metabolic variation. (Snyder-Calif)
W81-00707

EFFECT OF MILD TANNERY POLLUTION ON GROWTH AND EMERGENCE OF TWO AQUATIC INSECTS RHITHROGENA SEMICOLORATA AND EMPHEMERELLA IGNITA,
Paisley Coll. of Technology (Scotland). Dept. of Biology.
J. D. Hamilton, and J. Timmons.
Water Research, Vol 14, No 7, p 723-727, July, 1980. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Water sampling, *Tannery wastes, *Aquatic animals, *Mayflies, Benthic fauna, Water pollution effects, Streams, Water quality, Growth rates, Aquatic insects.

Monthly collections were made of aquatic invertebrates from a stony stream bed above and below a partially treated tannery effluent. Analyses of water samples indicated only slight differences in water quality parameters between the two sampling sites. It was concluded from findings in the analyses that mild tannery pollution which is sufficient to alter the species composition of the benthic invertebrate community did not influence the life histories and growth characteristics of the mayflies Rhithrogena semicolorata and Ephemerella ignita. It is suggested that this is likely to be the finding in the recovery zone downstream from severe organic pollution. However, this suggestion has not yet been tested on a suitable river with a heavy organic load and a natural re-purification pattern. (Baker-FRC)
W81-00741

AN INVESTIGATION INTO THE LONG-TERM EFFECTS OF RHINE WATER ON RAINBOW TROUT,
Netherlands Waterworks, Rijswijk. Testing and Research Inst.
C. L. M. Poels, M. A. Van der Gaag, and J. F. J. Van de Kerkhoff.
Water Research, Vol 14, No 8, p 1029-1035, August, 1980. 9 Fig, 2 Tab, 30 Ref.

Descriptors: *Toxicity, *Water pollution, *Rainbow trout, Rivers, Industrial wastes, Domestic wastes, Agricultural wastes, Fish physiology, Chlorinated hydrocarbon pesticides, Growth rates, Groundwater, Water quality, Rhine river, *Netherlands.

The possible negative influences of Rhine river water on rainbow trout (Salmo gairdneri) were evaluated. Trout were maintained in basins containing Rhine water (from the Lek River, a branch of the Rhine delta in the Netherlands) or ground-

water of drinking water quality for 18 months. When compared to trout kept in groundwater, those kept in Rhine water showed an inhibition of growth ($p < 0.005$ for weight and $p < 0.0005$ for length after 18 months), enlarged liver ($p < 0.05$ after 1 month) and kidneys ($p < 0.005$ after 9 months), reduced hemoglobin levels ($p < 0.005$ after 18 months), increased blood glucose levels ($p < 0.005$ after 12 months), a significant accumulation of chlorinated hydrocarbons in adipose tissue, and histological changes in the spleen and liver. It was concluded that Rhine water was chronically toxic to rainbow trout. These data support other experiments suggesting that the disappearance of the salmonids from the Rhine is due to the heavy pollution of this river from domestic, industrial, and agricultural wastes. (Geiger-FRC)
W81-00743

AN ECOLOGICAL RISK INDEX FOR AQUATIC POLLUTION CONTROL. A SEDIMENTOLOGICAL APPROACH,
National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab.
L. Hakanson.
Water Research, Vol 14, No 8, p 975-1001, August, 1980. 5 Fig, 23 Tab, 51 Ref.

Descriptors: *Mathematical models, *Heavy metals, *Water pollution, *Sediments, *Environmental effects, Lakes, Chemical analysis, Mercury, Cadmium, Copper, Chromium, Zinc, Polychlorinated biphenyls, Lead, Arsenic.

The development of an ecological risk index to be used as a diagnostic tool for determining the degree of pollution in lakes and basins is presented. The approach taken focuses on lake sediments and parameters that may be determined in a rapid, inexpensive and standardized manner from a limited number of sediment samples. The risk index was based on the following four requirements: (1) the ratio between the mean content of superficial sediment samples and the natural background levels of a particular toxic substance. (2) Toxic substances selected for measurement were PCB, Hg, Cd, As, Cu, Pb, Cr, and Zn. A number requirement was developed by summing the contamination factor for all selected toxic substances present in the sediment. (3) A sedimentological toxic factor was developed for each substance based on the individual toxicity of the substances selected. (4) The fact that different lakes and basins have different sensitivity to different toxic substances led to the development of the 'sensitivity factor.' These four requirements were developed into the potential ecological risk index. Risk index analysis results for 15 Swedish lakes of varying size, pollution status, and trophic status were presented. (McKeon-FRC)
W81-00747

EFFECTS OF STREAMBANK MATERIALS ADDITIONS UPON MICROBIAL ACTIVITIES OF TWO SUB-ARCTIC CANADIAN RIVERS,
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences.
L. J. Albright, K. V. Masuda, and G. L. Ennis.
Water Research, Vol 14, No 9, p 1363-1366, September, 1980. 5 Tab, 7 Ref.

Descriptors: *Rivers, *Sediments, *Dissolved oxygen, *Respiration, *Subarctic, Ice breakup, Aquatic productivity, Primary productivity, Microorganisms, Algae, Canada.

The dissolved oxygen (DO) levels and respiration rates of the Ogilvie and Swift rivers were evaluated at various times of the year as influenced by streambank and sediment additions in the context of microbial and bacterial biomasses and activities. In both rivers, levels of DO dropped significantly from early fall (9-15 mg/liter) to late winter (3-11 mg/liter) and remained at relatively high concentrations during the ice-free seasons of late spring following ice breakup (8-12 mg/liter) and summer (10-12 mg/liter). In late winter the experimentally determined respiration rates for both rivers were in the range of 0.023-0.048 mg 02/liter/day. When the river waters were treated with several soil horizon materials the respiration rates were markedly influenced. Most treatments > 0.10 g of streambank material/liter of water significantly increased oxygen utilization by the native aquatic microorganisms. Algal and heterotrophic productivities were also significantly increased. It is suggested that these rivers would tend to be most sensitive to pipeline related construction activity that would result in streambank and sediment materials additions in winter and least sensitive in late spring, following ice breakup, and early summer. (McKeon-FRC)
W81-00750

5D. Waste Treatment Processes

UV-OZONE AND UV-OXYGEN PROCESSES FOR COLOR REMOVAL FROM TEXTILE DYEING AND FINISHING WASTEWATERS,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
C. P. C. Poon, and B. M. Vittimberga.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127417, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, (1980), 22 p, 12 Fig, 7 Tab. OWRT A-071-RI(1), 14-34-0001-9042.

Descriptors: *Waste water treatment, *Textiles, *Dyes, *Color removal, *Photoactivation, Acetone, Chemical reactions, Biochemistry, Pigments, Acids, Dissolved oxygen, Industrial wastes.

Photochemical degradation of dye molecules was studied by exposing solutions with acid, direct and dispersed dyes to UV. Acetone as a high triplet energy sensitizer enchanced the color removal rate by more than 100 times. Dissolved oxygen was an energy quencher which could be removed by N2 bubbling. N2 bubbling also provided adequate mixing to bring the dye molecules in closer contact with the radiation source. The only adequate means of measuring color removal was to measure color units as described by the American Dye Manufacturer's Institute (ADMI) because the color and its predominant wavelength changed in the course of photodegradation. Studies of continuous flow models included a tray model as well as single, and multi-column models. A tray model was found less effective. Single and multiple-column models were equally effective for some acid dyes but the multiple-column model was more efficient for resistent dyes. The power consumption per unit volume of dye solution treated was calculated for all dyes.
W81-00503

STUDY OF THE POTENTIAL FOR WATER REUSE IN THE STEEL INDUSTRY,
Hydrotechnic Corp. New York.
For primary bibliographic entry see Field 3E.
W81-00513

FILTRATION SYSTEM FOR HOUSEHOLD SEWAGE,
Great Circle Associates, Walnut Creek, CA. (Assignee).
S. B. Mullerheim, and F. G. Williams, Jr.
U.S. Patent No 4,191,647, 17 p, 14 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 247, March 4, 1980.

Descriptors: *Patents, *Wastewater treatment, *Water pollution treatment, Domestic wastes, Filtration, Oxidation, Equipment, Instrumentation, On-site disposal system, Composting, Liquid level sensors.

A method and apparatus for treating wastewater such as sewage are disclosed. Designed principally for complete on-site wastewater treatment and disposal, the system separates wastewater into liquid wastes and solid wastes by filtration, treats the liquid wastes with a mild oxydizing agent and disperses them into unsaturated ground. The solid wastes are periodically removed, along with used portions of the paper filter medium and delivered, in the case of sewage, to a composting area where the still-fresh solids can be aerobically composted. Preferred and particularly advantageous embodiments of a filtering system, a sewage delivery system, a vacumm generating system, and a liquid level sensor, each of which may be used with the invention, are disclosed. (Sinha - OEIS)
W81-00526

SELF WASHING BELT STRAINER,
Q. L. Hampton.
U.S. Patent No 4,191,653, 5 p, 7 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 249-250, March 4, 1980.

Descriptors: *Patents, *Waste water treatment, Equipment, Sewage treatment, Screens, Filtration, Cleaning, Self-cleaning.

An endless driven belt strainer is adapted for use as a porous barrier in a channel containing a flowing liquid, such as a channel supplying raw sewage to a treatment plant. The belt strainer is composed of a number of endless porous wire or plastic screen strips arranged in side-by-side relation and which pass over a driving roller, guide rollers and a tension adjusting roller, all of which rotate in a frame having an upwardly inclined bottom portion which slopes away from the direction of flow of liquid to be cleaned. A top portion located above the liquid level is equipped with cleaning means for removing foreign matter from the belt strainer as it commences its return travel. Each porous strip is twisted 180 degrees during the initial part of its return travel above the flowing stream, so that during a subsequent downward travel of these screen portions the freshly cleansed liquid will pass through the downwardly traveling flight portion for removing any debris clinging to its outer surface. An additonal endlessly driven cleaning device operates in front of the upwardly traveling screening surface for removing particles which cannot pass through the screen and are too large or of a nature such that they will not be taken out of the channel by the screen alone. (Sinha - OEIS)
W81-00527

TWO ZONE PROCESS FOR BIOLOGICAL TREATMENT OF WASTE WATER,
Canadian Liquid Air Ltd., Montreal (Quebec). (Assignee).
G. Savard, R. G. H. Lee, and D. Hornsey.
U.S. Patent No 4,192,740, 21 p, 13 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 625-626, March 11, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Biological treatment, Water purification, Biochemical oxygen demand, Oxygen, Microorganisms, Equipment, Monitoring.

A process is provided for treating waste water biological and clarifying the biologically treated water in a single vessel rather than in separate vessels. It is possible to treat water in this system containing much higher concentration of waste. In the process the supply of oxygen to the biological reaction zone is carefully monitored to meet the biological oxygen demand and avoid the occurrence of undissolved oxygen in the form of gas bubbles in the biological reaction zone or the clarification zone. Further improvements are provided in oxygen dissolving devices rendering them especially suitable for the two zone treatment. (Sinha - OEIS)
W81-00528

PROCESS AND APPARATUS FOR THE BIOLOGICAL TREATMENT OF WASTE WATER,
Degremont S.A., Rueil-Malmaison (France). (Assignee).
J. Bernard, J. Bebin, and J-P. Hazard.
U.S. Patent No 4,192,742, 8 p, 1 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 626, March 11, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Biological treatment, Filtration, Biochemical oxygen demand, Oxygenation, Equipment, Filters, Superoxygenation.

Waste water to be treated is introduced into an enclosed gas tight oxygenation chamber. An oxygen-containing gas is also introduced into the

chamber at a pressure higher than atomospheric pressure so that oxygen is dissolved in a quantity higher than the saturation concentration value of oxygen in the waste water at atmospheric pressure, thereby superoxygenating the waste water. The superoxygenated waste water maintained at higher pressure is then passed into an enclosed gas tight filtering chamber which is separate from the oxygenation chamber and which is also maintained at higher pressure. No other oxygen is introduced and the superoxygenated waste water is passed through a biological filter bed thereby biologically purifying the waste water which is then removed from the filtering chamber. (Sinha - OEIS)
W81-00529

RECLAMATION OF CEMENT SLURRY,
Fowlerex Pty. Ltd., Brookvale (Australia). (Assignee).
M. G. Hood.
U.S. Patent No 4,192,745, 8 p, 5 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 628, March 11, 1980.

Descriptors: *Patents, *Waste water treatment, *Industrial waste, Water pollution treatment, Separation techniques, Suspended solids, Water reuse, Cements, Equipment, Cement slurry, Concentration.

The invention provides a machine which concentrates the slurry and stores the concentrated slurry as a suspension of more or less consistent density throughout so enabling the concentrated slurry to be remixed into fresh concrete and preventing the settling and build up of sludge which otherwise occurs in the pits. Thus the machine has the ability to accept slurry from settling pits or aggregate reclamation plant, to separate the cement from most of the water, to store the separated material and to allow relatively clean water to flow back into the pits. Both the concentrated slurry and the water may be reused in fresh concrete. (Sinha - OEIS)
W81-00530

LIQUID CLARIFICATION SYSTEM,
K. S. Arvanitakis.
U.S. Patent No 4,192,746, 13 p, 11 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 628, March 11, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Separation techniques, Water purification, Chemical reactions, Chemical precipitation, Filtration, Equipment.

This invention relates to a liquid/solids separation system utilizing a settling clarifier to remove solid material suspended in a liquid through the introduction of chemicals and inert solids to accelerate the settling rate or precipitation of the solids from the liquid. The effluent discharge may be further processed, discharged, or recycled depending upon the nature of the effluent. The semi-solids material which is settled or precipitated is passed to a storage reservoir where this material is further processed in order to obtain predetermined uniform quantity of solids material in the sludge. This material is then discharged into a filtration system where the solids are utilized to form a filter cake on the septum of the system filters with the filtrate being discharged for further processing, disposal or reuse depending upon the nature of the liquid. (Sinha - OEIS)
W81-00531

SELECTIVE MULTIPLE ELECTRODE WASTE WATER TREATING SYSTEM,
A. S. King.
U.S. Patent No 4,193,859, 5 p, 2 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 1000-1001, March 18, 1980.

Descriptors: *Patents, *Waste water treatment, Water pollution treatment, *Electrodes, *Flocculation, Selectivity, Integrated control measures, Equipment.

A number of individual treaters, each containing a pair of oppositely charged electrodes, are arranged circularly around a tank into which all of the treaters empty. A common supply manifold for all of the treaters brings waste water into the system for treatment by any selected one of the treaters upon opening a control valve associated with the treater and closing control valves associated with the remaining treaters. Each treater contains an electrode that is constructed from a material differing from that in the remaining treaters so that a particular treater may be selected for use based upon the predicted reaction of the material from which its electrode is made with the particular constituents of the waste liquid being treated. The central tank into which all treaters empty includes a pair of oppositely charged electrodes of its own to expose the once treated liquid to yet a second electric field, and there is a special structure associated with the lowermost discharge end of the electrode pair within the tank which is so arranged and configured that it reduces turbulence adjacent the floor of the tank to encourage settling out of floc produced by the treating process. (Sinha - OEIS)
W81-00532

FERRITE FLOCCULATING SYSTEM,
General Electric Co., Schenectady, NY. (Assignee).
G. M. J. Slusarczuk, and R. E. Brooks.
U.S. Patent No 4,193,866, 5 p, 1 Fig, 1 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 1003, March 18, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Suspended solids, *Flocculation, Separation techniques, Organic compounds, Magnetic ferrite.

The invention relates to the purification of aqueous polluted liquid containing suspended particulate impurities by adding a magnetic ferrite powder which is suspendible in the liquid and then adding an aqueous flocculating solution comprised of an aqueous solution of polyethyleneimine for co-flocculating the particulate suspended impurities and the magnetic powder and producing a dense flocculated mixture which settles rapidly in a matter of minutes. (Sinha - OEIS)
W81-00533

WASTEWATER AND WASTEWATER SOLID PROCESSING SYSTEM,
M. Brucker, R. J. Matika, and M. E. McMican.
U.S. Patent No 4,193,869, 16 p, 11 Fig, 24 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 1003-1004, March 18, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Domestic wastes, Separation techniques, Sludge treatment, Filtration, Coagulation, Evaporation, Water reuse.

The invention is a system for processing wastewater and wastewater solids. It accepts wastewaters such as domestic or industrial sewage, food-processing wastewaters and associated solid matter, and other wastewaters of like nature. It removes a substantial fraction of the solid matter contained in suspension, dewaters the solid matter, transports the pressed solid matter to a storage facility for further processing or optionally for immediate disposal, optionally further processes the solid matter to produce a soil supplement or subjects solids to microwave treatment which renders the material sterile. The system clarifies the influent wastewaters by a water separator and air flotation units, both with and without the use of chemical coagulants as the case may be, and discharges the clarified wastewaters at this stage of treatment, or alternatively transports the clarified wastwaters to a filter unit or a filter bed unit which completes the treatment process by evaporating or transpiring pure water to the atomosphere while absorbing all contaimants in the filter bed media. The physical-chemical system processes the wastes in 60 minutes or less thus preventing the waste from ever going septic and eliminating the need for large tanks. (Sinha-OEIS)
W81-00534

APPARATUS FOR CLARIFYING LIQUID,
Envirotech Corp., Menlo Park, CA. (Assignee).
M. J. Lillywhite.
U.S. Patent No 4,193,877, 9 p, 7 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 1006, March 18, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Sewage treatment, Activated sludge, Separation techniques, Skimming, Equipment.

An apparatus for clarifying liquid waste has a tank with a center column mounted in its center and suction pipes to remove sludge which has settled to the floor of the tank. The center column is provided with an influent trough to introduce liquid waste into the tank, and ports are formed in the upper part of the column to introduce waste into the influent trough. The ports and the influent trough are located at about the level of the liquid in the tank so that the waste leaving the ports creates a radially outward current on the surface of the liquid in the tank to carry scum towards the periphery of the tank for collection. (Sinha - OEIS)
W81-00535

SAVING THE LAKES,
Washington State Water Research Center, Pullman.
For primary bibliographic entry see Field 2H.
W81-00549

TREATMENT OF INDUSTRIAL LIQUID WASTES BY ELECTROFLOTATION,
Salonika (Greece).
K. A. Matis.
Water Pollution Control, Vol 79, No 1, p 136-142, 1980. 5 Fig, 11 Ref.

Descriptors: *Flotation, *Waste water treatment, *Sludge treatment, *Design data, *Electrical design, Coagulation, Electrolytes, Biological treatment, Separation techniques, Gases, Anodes, Cathodes, Membranes, Industrial wastes, Laboratory tests, Hydrogen ion concentration, Sea water, Suspended solids, Biochemical oxygen demand.

Batch tests and continuous flow experiments were conducted in a laboratory using an emulsified oil dispersion and an alum dilution to obtain data to evaluate the design and effectiveness of a continuous flow electroflotation sludge thickening unit. Electroflotation is used to reduce BOD and suspended solids in industrial effluents. Results showed a retention period of 55 min in continuous operation and 30-min retention period in batch tests. The continuous flow experiments showed the reduction in concentration to be about 90% at a current density of 300 A/sq m. The feed concentration ranged from 1,000-1,500 mg/liter, and the effluent contained 100-150 mg/liter. As with air flotation and sedimentation, the performance of the electroflotation unit depends upon inlet design which is critical to the reduction of turbulence and maintenance of intact bubbles. With horizontal electrodes separated by a membrane, it was observed that one gas activates the process while the other contributes to the transfer of coagulated matter. A saving of electricity was observed. pH was determined to be significant when seawater is the electrolyte. The retention period and the effluent concentration are strongly dependent on pH, and flotation rates are high within a narrow pH range. Further research could improve bipolar cell design and maximize generation of gas. (Titus-FRC)
W81-00567

EXPERIENCES OF HIGH-RATE BIOLOGICAL FILTRATION AT DERBY SEWAGE-TREATMENT WORKS,
Severn-Trent Water Authority Birmingham (England). Derwent Div.
P. B. Smith, and D. Yates.
Water Pollution Control, Vol 79, No 1, p 87-98, 1980. 1 Fig, 5 Tab, 3 Ref.

Descriptors: *Waste water treatment, *Odor, *Filtration, Sludge, Pre-treatment, Trickling filter, Or-

ganic loading, Protozoa, Anaerobic conditions, Nitrates, Treatment facilities, Biochemcial oxygen demand, Biological treatment.

A high-rate biological filtration unit was built at Derby, England using Flocor E plastic media in an attempt to remedy the overloaded existing system. Constructed between July, 1973 and September 1975, the plant consists of 6 filter units, 24m in diameter and 3m deep, each containing 1,132 cu m of medium. One of the filters was divided into quadrants and was used for an experimental comparison of Flocor E media against three other competitive media. The work at Derby has demonstrated that high-rate biological filtration is an economically viable process, and when at an intermediate stage, is capable of significant reductions in the applied organic loading. All four media achieved 40% BOD removal by July, 1976. It produced an effluent suitable for further treatment by normal low rate biological filtration, giving a corresponding improvement in effluent quality. Problems arose with regard to sludge production, which was higher than expected and produced significant effects on other treatment units. The unit was forced to cease operation in December, 1976 when the surrounding community complained of a severe odor, the exact cause of which has not yet been ascertained. The compound could be a biological-degradation product, could be present in the original feed liquor, or could be a consequence of synergistic interactions with other chemicals discharged in the vicinity. A discussion of this paper is also presented. (McKeon-FRC
W81-00568

A STUDY OF THE PROTOZOAN AND METAZOAN POPULATIONS OF THREE OXIDATION DITCHES,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
J. E. P. Poole, and J. C. Fry.
Water Pollution Control, Vol 79, No 1, p 19-27, 1980. 10 Tab, 15 Ref.

Descriptors: *Protozoa, *Metazoa, *Oxidation lagoons, Biomass, Suspended solids, Biochemical oxygen demand, Activated sludge, Rotifers, Nematodes, Sewage treatment, Water quality, Sewage effluents.

The protozoan and metazoan populations inhabiting three oxidation ditches over a 1-mo period compared with those reported to occur in activated-sludge plants. The relationship between protozoan species in the mixed liquor and the BOD of the final effluent is also examined. Oxidation ditches appeared to support populations of peritrichs, crawling ciliates, bdelloid rotifers, nematodes, and aeolosomatid oliogochaetes. If high concentrations of mixed-liquor suspended solids were maintained, the biomass of nematodes and aeolosomatids far exceeded that of protozoa. Large populations of protozoan species were found that rarely occur in conventional activated-sludge plants, and relatively larger populations of metazoa were also found in the oxidation ditches. The abundance of protozoan species was found to fluctuate over as little as 11-14 days, nevertheless the monthly average BOD in the final effluent could be predicted from the protozoan species present in the mixed liquor. In a discussion following the article, it is noted that the presence of a more varied metazoan population in the oxidation ditches was primarily due to the longer retention periods than those in activated-sludge plants. It is also explained that there were few differences between the sludges except for a higher concentration of suspended solids in one of the ditches. (McKeon-FRC)
W81-00573

SEWAGE DISPOSAL IN DEVELOPING COUNTRIES: SOME THROUGHTS,
Allott and Lomax, Manchester (England).
R. Foster.
Water Pollution Control, Vol 79, No 1, p 28-41, 1980. 13 Fig.

Descriptors: *Sanitary engineering, *Sewage treatment, *Domestic wastes, *Environmental sanitation, Septic tanks, Sewers, Regional economics, Sewerage, Biological treatment, Governments, Municipal wastes, Water requirements, Economic feasibility, Africa, History.

The history of the sewerage system in the United Kingdom is reviewed and contemporary sanitation projects in selected developing countries are described. In the Middle Ages sanitation ranged from the midden heap and the privy to the Rochedale system in which disinfected pails in outhouses were transferred to processing plants by vans. Water closets developed in the late eighteenth century improved domestic health by removing waste from houses, yet caused pollution of rivers used as sewers. Sewage treatment began in the late nineteenth century. The present state of technology with computer controlled plants and biological treatment is an outgrowth of the water-carriage system which has historical roots. In developing countries sanitation problems include limited water, funding, and architechture as well as tropical climates and scarce transportation. Appropriate facilities include variations on the pit latrine such as the vault latrine with watertight composting, the aqua privy with a water-filled pit, and the septic tank which accepts all domestic waste and connects to internal plumbing. Cities in Saudi Arabia and Ghana have recently constructed water-carriage systems to accommodate the needs of large, high density populations and make use of available water. Similar sanitation options are under study in Nigeria, where cost constraints, the necessity of property demolition and education programs are complicating factors. (Titus-FRC)
W81-00574

RECOVERY OF PROTEIN AND FAT FROM FOOD INDUSTRY WASTE WATERS,
Alwatech Ltd., High Wycombe (England).
A. P. Hopwood.
Water Pollution Control, Vol 79, No 2, p 225-235, 1980. 4 Fig, 11 Tab, 13 Ref.

Descriptors: *Sludge disposal, *Environmental sanitation, *Food processing industry, *Waste water treatment, *Industrial wastes, Soil contamination effects, Recycling, Pollutants, Treatment facilities, Chemical precipitation, Biochemical oxygen demand, Suspended solids, Coagulation, Proteins, Dewatering, Drying, Animal diseases, Microorganisms, Lipids, Flocculation, Economics.

With the increasing demand for the slaughter of animals for human consumption, new methods must be found to control the pollution connected with waste water from abattoirs and meat and poultry packing plants. Animal proteins may be recovered from waste water by precipitation with purified lignosulphonates (LS). LS are a byproduct of sulphite cellulose production and occur in sulphite lye. A complete primary waste-water treatment system for food industry effluents has been developed using the LS method. Several LS plants have been in full-scale operation for about seven years. Average percent removals of BOD, suspended solids, and free oil and grease over a 10-day period from the waste water of a beef abattoir using the LS treatment was 79, 87, and 95%, respectively. LS precipitated proteins have been used as animal food additives with no adverse effects when the LS concentration in the total diet is below 3%. The heat coagulation, dewatering and heat drying steps of the LS process are effective in removing viable microorganisms thus reducing the risks of animal disease transfers. Water recycling in LS processing seems feasible, however the fact that it is not natural water has prevented the EPA from allowing its use for human consumption. The major advantage of protein and fat recovery by LS treatment is the elimination of offsite sludge disposal. The economics of the process in the United Kingdom and the effectiveness of various flocculants are also mentioned in a discussion following the article. (Geiger-FRC)
W81-00580

OILY EFFLUENT TREATMENT BY THE BP TREATMENT PROCESS,
British Petroleum Co. Ltd., London (England).
G. F. Oldham.
Water Pollution Control, Vol 79, No 2, p 236-243, 1980. 1 Tab.

Descriptors: *Oil wastes, *Biological treatment, *Filtration, *Waste water treatment, *Water pollution treatment, Sludge disposal, Polyelectrolytes, Incineration, Dewatering, Flocculation, Pilot plants, Operating costs, Activated sludge, Phenols, Sulfides, Installation costs, Industrial wastes, Costs, Flotation.

Conventional treatment of oily effluents from refineries or petrochemical factories consisted of flocculation and/or flotation with adsorption onto flocs such as ferric hydroxide and treatment of activated sludge by thickening, dewatering and incineration. In the early 1970s, the British Petroleum (BP) Sweden refinery was required to meet a treated effluent quality of 5 mg/liter oil, 21 mg/liter BOD, and 1 mg/liter standards for phenols and sulfides. Since the existing biological treatment had several flaws, chemical flocculation with ferric salts was examined as an alternate treatment. This method brought problems of sludge removal, so biological filtration and activated sludge treatment were considered. Biological filtration was found to have important advantages over activated sludge with regard to high inlet temperatures, pH variations, sudden density changes, and turn-down ratios. Biological filtration can be fully automated thus reducing operating costs. The filters for biological treatment were also cheaper than activated sludge. Results at pilot plants and full scale operations using granular filtration treatment of oily effulents were good. Oily emulsions can be treated by polyelectrolytes to produce waters suitable for biological filtration. Installation costs of the BP process plants were about 40% of those of conventional treatment sites, including incinerators. Operational costs of the BP facilities were approximately 5% of those of conventional processes. Effluents that have been treated by the BP technique include those from simple refineries to complex refineries with oil terminals and ballast water. Successful pilot tests have also been run on petrochemical effluents and North Sea oil ballast water at low temperatures and high salt content. An Extensive discussion follows the article. (Geiger-FRC)
W81-00581

UPRATING ACTIVATED-SLUDGE PLANTS USING ROTARY BIOLOGICAL CONTACTORS,
Philadelphia Water Dept., PA. Water Pollution Control Div.
C. F. Guarino, M. D. Nelson, M. Lozanoff, and T. E. Wilson.
Water Pollution Control, Vol 79, No 2, p 255-271, 1980. 7 Fig, 17 Tab.

Descriptors: *Aerobic treatment, *Sewage treatment, *Activated sludge, Pilot plants, Microorganisms, Biological treatment, Operating costs, Settling velocity, Aeration, Biomass, Energy, Conservation, Sewage sludge.

The uprating of the Philadelphia sewage treatment plants by the adoption of the Surfact process is described. Surfact physically merges a rotating biological contactor (RBC) with a diffused air aeration tank which results in the ablity to handle large biomass at low energy costs with little maintenance. Discs could be placed into existing aeration tanks as soon as supports were constructed. Preliminary pilot-scale studies were conducted in 1974 to determine whether the RBC units would rotate when placed in aeration tanks. Favorable results were achieved. A full-scale RBC caused the media to rotate with the surface hyraulic motion which allowed minimal energy requirements. When a prototype system was examined through six modes, similarities were found between the Surfact and the conventional activated-sludge system. During the 11 months of Surfact operation, surface biology studies, soluble BOD profiles, settling tests, disc rotation experiments, and power consumption evaluations were conducted. Discs supported a growth equivalent to 1,500 mg/liter mixed liquor suspended solids. Microbial populations of disc solids and suspended cultures were nearly the same and resembled those found in activated sludge. Sludge settlement demonstrated initial velocities of 5.8 m/hr. The present proto-

type had some oxygen limitations that are currently being corrected. Step feeding processes will be implemented to reduce solids overloading of the final clarifier and disperse the organic load to all discs. Upgrading to Surfact may be accomplished rapidly, and its low costs of operation make it an attractive choice for the construction of new secondary facilities. A discussion follows the article. (Geiger-FRC)
W81-00582

EXPERIENCE IN OPERATING THE DEEP-SHAFT ACTIVATED SLUDGE PROCESS,
Anglian Water Authority, Huntingdon (England). Essex Sewage Div.
O. C. Collins, and M. D. Elder.
Water Pollution Control, Vol 79, No 2, p 272-285, 1980. 3 Fig, 2 Tab, 6 Ref, 1 Append.

Descriptors: *Denitrification, *Sewage treatment, *Activated sludge, Foaming, Surfactants, Sludge disposal, Settling velocity, Biological treatment, Organic wastes, Biochemical oxygen demand, Treatment facilities.

A deep shaft to treat sewage at the Marsh Farm, Tilbury Treatment Works, England was constructed to meet BOD standards of 60 mg/liter and to handle maximum daily loads of 7,050 kg BOD. The shaft was 130 m deep and 1.86 m in diameter and was designed for a sewage retention period of 1.5 hr at a maximum feed rate of 277 cu m/hr. The shaft was capable of removing high organic loads while producing an effluent which was acceptable for discharge to the estuarial River Thames. Problems with degassing and settlement still need to be overcome, but no foul odors or fly populations accompanied the process. The operation of the shaft requires considerable attention, but automation may solve this situation. Screening and degritting are necessary for effective treatment of crude sewage. The compact layout of the shaft allows easy access to operation areas. Sludge production has been much greater than was originally predicted, and difficulties exist in solids separation. In discussions following the article, mention is made of the problems of foaming to which the deep-shaft process lends itself. If surfactants are present in the sewage material, foaming becomes a great nuisance causing unsightly working conditions. To date the operation of the deep-shaft facility is very complex, and design standard effluents have not been consistently achieved. (Geiger-FRC)
W81-00583

FLUIDIZED- AND EXPANDED-BED REACTORS FOR WASTE-WATER TREATMENT,
Water Research Centre, Stevenage (England).
P. F. Cooper, and D. H. V. Wheeldon.
Water Pollution Control, Vol 79, No 2, p 286-306, 1980. 7 Fig, 7 Tab, 68 Ref.

Descriptors: *Denitrification, *Biological treatment, *Sewage treatment, *Waste water treatment, Reviews, Landfills, Water treatment, Potable water, Sewage sludge, Suspended solids, Industrial wastes, Particle size, Fluidized beds, Expanded beds, Carbon, Sewage effluents.

The state of the art of fluidized- and expanded-bed technology is reviewed with a brief account of work at the Water Research Centre's (WRC) Stevenage Laboratory in England in denitrification of sewage effluents using expanded beds. This method of removing the non-settleable organic content of sewage reduces considerably the size of treated biomass. At the WRC facility, methanol is used as the main carbon source in the reactor. Denitrification became linear with respect to time in the 1.0- to 3.0-m height zone, and the volumetric rate of removal in this part of the bed was 4.6 kg Oxd-N/cu m/day. Calculations of the sludge production rate showed that at a sludge age of 14 days, production was 0.17 g biomass volatile solids concentration/g methanol. It was possible to use settled sewage as the carbon source for denitrification in an anoxic fluidized bed with a conical distribution system. However, it was considered doubtful that an expanded-bed or fluidized system would operate successfully using settled sewage as the carbon source. The fluidized-bed system could be designed in modular fashion to replace easily an existing overloaded plant by a more powerful system. Sludge disposal from bed systems could be directed to landfills. The need for a clarification stage to handle suspended solids is still debatable. Fluidized beds will most likely be used for denitrification of river or bore-hole waters prior to potable water treatment, to update existing sewage treatment facilities, and to treat concentrated industrial wastes. A discussion follows the article. (Geiger-FRC)
W81-00584

THE CLARIFICATION OF EFFLUENT FROM AN ACTIVATED-SLUDGE PLANT USING DISSOLVED-AIR FLOTATION,
Universidade Federal do Rio de Janeiro (Brazil). Inst. de Quimica.
J. E. L. Maddock, and E. J. Tomlinson.
Water Pollution Control, Vol 79, No 1, p 117-125, 1980. 7 Fig, 4 Tab, 4 Ref.

Descriptors: *Flotation, *Activated sludge, *Sewage treatment, *Aerobic tratment, *Coagulation, Settling basins, Separation techniques, Water pollution treatment, Sludge, Turbidity, Effluents, Pilot plants.

A pilot-scale dissolved-air flotation (DAF) unit was designed and operated at the existing Peterborough sewage treatment works in England. The pilot unit was used to demonstrate that DAF after the secondary sedimentation basin could reduce suspended solids in the plant effluent to < 30 mg/liter of suspended solids (SS). The maximum hydraulic load which could be applied to the DAF unit while clarifying a dilute suspension of solids was approximately 12 cu m/sq m hr. This had to be reduced proportionately when the SS concentration was > 800/liter. The minimum sludge recycling rate required to promote satisfactory clarification of a dilute suspension by flotation was 7%. Increased rates were required when the SS concentration in the DAF feed exceeded about 400 mg/liter. Solids separated by floation were not removed effectively by scrapers even after modifications were made. The addition of coagulants and polymers did not reduce the SS in the effluent over that without any chemical addition (this was usually < 15 mg/liter). (McKeon-FRC)
W81-00587

DETOXIFICATION OF KRAFT PULPMILL EFFLUENTS BY FOAM SEPARATION.
Water and Pollution Control, Vol 118, No 9, p 18-20, September, 1980.

Descriptors: *Foam fractionation, *Bleaching wastes, *Waste water treatment, *Pulp and paper industry, Biodegradation, Surfactants, Pilot plants, aeration, Wood wastes, Economic feasibility, Sulfides, Organic compounds, Laboratory tests, Industrial wastes.

Foam fractionation is an alternative to biological processing of pulp and paper industry effluent which achieves detoxification at less expense. Sulfides, mercaptans, unsaturated fatty acids, resin acids, chlorinated organics and other wood extractives are among the substances in bleached effluents that are toxic to fish and other life. The foam fractionation process exploits the phenomenon that toxic surfactants are collected in the foam phase which is readily formed in aeration of bleached pulpmill effluent. The foam is collected and treated separately. Laboratory and pilot plant studies conducted during a 7-yr period in Vancouver, British Columbia determined that the surface area of foam generated must be proportional to the toxicity of the effluent and averages 30 sq m of area per liter effluent. The configuration of aerators within the foam stage is also critical. Detoxification is optimized with a three-stage system and a 20-min retention period in each stage. Conventional biological treatment of the extracted foam readily achieved detoxification. Eighty-three percent of 205 whole mill effluents were detoxified in less than 5 hr under laboratory conditions. Experiments suggest that this method has application throughout the bleach kraft industry and in particular in situations where land is expensive and reductions in treatment time are advantageous. (Titus-FRC)
W81-00597

USE OF THE DEEP-SHAFT-PROCESS IN UPGRADING AND EXTENDING EXISTING SEWAGE-TREATMENT WORKS,
Thames Water Authority, London (England). Vales Div.
G. C. Cox, V. H. Lewin, J. T. West, W. J. Brignal, and D. L. Redhead.
Water Pollution Control, Vol 79, No 1, p 70-86, 1980. 6 Fig, 5 Tab, 22 Ref.

Descriptors: *Pilot plants, *Municipal wastes, *Hydrostatic pressure, *Sludge digestion, *Sewage treatment, *Filtration, Depth, Nitrification, Construction costs, Toxins, Heavy metals, Waste dilution, Underground, Oxygenation, Biological treatment.

The deep shaft process of sewage treatment was tested in a pilot plant and evaluated for effectiveness in municipal sewage treatment. Findings indicate that this process is suited to areas with restricted land and to sewage with high carbon content. In the pilot plant the shaft extended to a depth of 61 m. Degritted sewage enters a settlement tank where anaerobic digestion, precipitation of heavy metals, and dilution take place. In the shaft, hydrostatic pressure is used to effect high oxygen transfer efficiencies. Carbon dioxide and nitrogen gas are released as bubbles. The effluent then undergoes degasification either through vacuum methods or bubble stripping followed by settlement and subsequent filtering for nitrification. Experiments revealed that both oxygen transfer efficiency and construction costs increase with the depth of the shaft. Effluent samples produced ranged from 72 to 96% nitrified depending on the degree of loading of the filters. On two occasions during the three month test period toxic discharges with abnormal pH occurred. This method is limited in its ability to dilute toxins because the volume of the shaft is lower than that of conventional sludge treatment systems. Development of a biological monitoring system for control of effluent is proposed. (Titus-FRC)
W81-00608

PRIMARY FLOCCULATION OF CADMIUM PLATING PLANT EFFLUENT: IMPROVED OCCUPATIONAL HYGIENE AND EFFLUENT QUALITY,
Hainsworth Research Centre, Hull (England).
A. Ashton.
Water Pollution Control, Vol. 79, No 3, p 421-424, 1980. 5 Fig, 2 Ref.

Descriptors: *Cadmium, *Industrial wastes, *Flocculation, Sulfates, Metals, Chemical precipitation, Chlorine, Hydrogen ion concentration, Water quality, Effluents, Water pollution sources, Laboratory tests, Toxicity.

Ferrous sulfate and aluminium sulfate were tested for use as primary flocculants of cadmium plating plant effluent in an effort to improve the quality of effluent and the poor occupational hygiene associated with a static drag-out. After destruction of the cyanide in a diluted sample of the plating effluent at a pH of 11.0 to 11.5 by the addition of a slight excess of hypochlorite, the flocculent under study was added until the pH was lowered to the desired level (9.5). Of the two flocculants, ferrous sulfate was somewhat superior with respect to rate of settlement, effective pH range, and effective concentration range. In addition, when ferrous sulfate was added, the pH was reduced as metal hydroxide was precipitated, and there was reduction in the level of available chlorine, both immediately and after standing for 1-2 hr. By using ferrous-sulfate flocculation in the treatment of dilute cadmium plating effluent, it should be possible to operate an electroplating plant with a flowing drag-out tank. In this way, occupational hygiene can be improved by avoiding batch treatment of heavily-contaminated effluents from static drag-outs. Effluent quality would also be improved with respect to cadmium, pH, and available chlorine levels. (McKeon-FRC)
W81-00614

ACTIVATED SLUDGE SETTLEMENT - SOME SUPPOSITIONS AND SUGGESTIONS,
Birmingham Univ., (England). Dept. of Civil Engineering.
C. F. Forster, and J. Dallas-Newton.
Water Pollution Control, Vol 79, No 3, p 338-351, 1980. 11 Fig, 5 Tab, 17 Ref.

Descriptors: *Sewage treatment, *Activated sludge, *Sewage sludge, Suspended solids, Design, Aerobic treatment, Microbiology, Waste water treatment, Flocculation, Coagulation, Settling basins.

The causes of poor settling characteristics of activated sludge are discussed along with laboratory measurements which can be used to predict the settleability of sludge. Settling rates are determined by the microbiology and the surface biochemistry of the sludge. In sludge dominated by filamentous species, the individual flocs are held apart in a huge three-dimensional matrix hindering both the downwards motion of the solids and the upward flow of liquid. In some sludges, a large repulsion factor due to surface biochemistry can hold the particles far enough apart to result in poor settling. A relationship was shown between the sludge volume index (SVI) laboratory measurement and chemical parameters which could affect the nature of the sludge surface. The SVI should be used as the prime operational index that can be used in conjunction with chemical parameters to predict bulking. The SVI should remain as an excellent design parameter, from which sludge recycle rates and sedimentation tank loading rates can be calculated. A discussion follows the presentation of the paper. (McKeon-FRC)
W81-00617

DEVELOPMENT OF THE BRISTOL REGIONAL SEWAGE-TREATMENT WORKS AND ASSOCIATED SEWERAGE SCHEME,
Wessex Water Authority, Bristol (England).
P. H. Steel.
Water Pollution Control, Vol 79, No 3, p 333-337, 1980. 3 Fig, 2 Tab, 5 Ref.

Descriptors: *Sewage treatment, *Sewage districts, *Sludge disposal, *Planning, Interceptor sewers, Cost allocation, Domestic wastes, Pumping plants, Hydraulic equipment, Sewers, Sludge digestion, Reservoir construction, Sewerage, Economics, Construction, Ultimate disposal.

The development of the Bristol, England regional sewerage and sewage-treatment scheme is described, future programs are identified, and priorities are suggested. Construction was begun in 1959 and was planned to be carried out in stages over a 20- to 30-year period to maintain an appropriate rate of expenditure given the expected increase in the contributing population. The plant is presently 65% complete. Extensions of the plant began in 1970 and included an activated sludge plant, a sludge digestion plant, an industrial-water reservoir, pumping station, and generating station. As a result of growth and increase in flow, both the hydraulic capacity and sedimentation capacity of the plant have declined, producing consequent declines in sludge and effluent recovery. Since 1968, over 900 tonnes/day of liquid digested sludge have been dumped in the deep water of Bristol Channel by ship. Future programs are designed to accomplish the initial objectives of removing all crude discharges and connecting outmoded sewers to the works. By 1995, certain interceptors shall be extended and constructed. It is suggested that adequate sludge treatment capacity be achieved by 1982 and that hydraulic deficiencies be remedied by 1984. This scheme is the most economical sewage-treatment works in the region and reflects both the benefit of size and lower standard of effluent required. In a discussion following the article, questions concerning costs and the safety of effluent discharge into the Bristol Channel are raised. (Titus-FRC)
W81-00618

BIOOXIDATION IN A CONTINUOUS ACTIVATED SLUDGE PROCESS,
Instytut Ksztaltowania Srodowiska, Katowice (Poland). Dept. of Water and Wastewater Treatment.
For primary bibliographic entry see Field 7B.
W81-00624

MICROBIAL VIABILITY MEASUREMENTS AND ACTIVATED SLUDGE KINETICS,
Oregon State Univ., Corallis. Dept. of Civil Engineering.
P. O. Nelson, and A. W. Lawrence.
Water Research, Vol 14, No 3, p 217-225, March, 1980. 6 Fig, 4 Tab, 39 Ref, 1 Append.

Descriptors: *Waste water treatment, *Model studies, *Biological treatment, *Activated sludge, Sewage bacteria, Organic matter, Adenosine triphosphate, Spectrometry, Laboratory tests, Kinetics, Slurries, Suspended solids, Volatility, Biodegradation, Waste treatment, Microorganisms, Biomass.

A laboratory investigation was conducted to determine the influence of microbial viability data on a frequently used steady-state kinetic model of slurry-type process of biological waste-water treatment. The luciferin-luciferase firefly lantern extract method coupled with a liquid scintillation spectrometer was used to measure adenosine triphosphate (ATP) levels as an indication of microbial viability. The microbial viability of activated sludge mixed liquor volatile suspended solids (MLVSS) was found to have a functional relationship with the retention time of the biological solids. Microbial viability of the MLVSS was essentially 100% at low bilogical solids retention times. Conversely, at higher values of biological solids retention time characteristic of normal activated sludge processes, The MLVSS microbial viability decreased to nearly a constant value. Microbial viability of the MLVSS also affected values of the model coefficients. It was concluded from mass balance studies and ATP values that the MLVSS of an activated sludge system treating a soluble organic waste could be composed of three distinct systems, namely active or viable microbial solids, inert microbial debris solids, and nonviable biodegradable microbial solids. (Geiger-FRC)
W81-00627

METHODS FOR DETECTION OF VIRUS IN WASTEWATER, APPLIED TO SAMPLES FROM SMALL SCALE TREATMENT SYSTEMS,
Royal Veterinary and Agriculture Coll., Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
For primary bibliographic entry see Field 5A.
W81-00631

LABORATORY APPLICATION OF SECONDARY SEWAGE EFFLUENT TO ARGILLACEOUS LIMESTONE,
Guam Univ., Agana. Water Resources Research Center.
P. A. Cowan, and R. N. Clayshulte.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137739, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No 18, 1980. 56 p, 14 Fig, 10 Tab, 44 Ref, 2 Append. OWRT B-002-GUAM(1), 14-34-0001-9066.

Descriptors: Sewage, *Sewage treatment, Sewage disposal, *Limestones, Sewage effluents, River, *Water quality control, Laboratory tests, Nutrient removal, Guam, Mariana Islands, Micronesia.

Secondary sewage effluent and river water (control) were applied to a series of laboratory lysimeter columns containing argillaceous limestone. Nitrates naturally deposited in the limestone were leached after semi-continuous water loading. Mass balance data of river water percolate with low nutrient input levels showed nitrogen removal and phosphorus release. Phosphorus release was attributed to fine particulate matter flushed from the lysimeters. River water leachate was generally high quality. Sewage effluents with high nitrate concentrations leached through the limestone media yeilding mean percolate concentrations of 8.0 plus or minus 0.4 and 14.3 plus or minus 8.7 mg/l at a depth of 2.74 m. the limestone was unable to remove nitrogen. Phosphorus was initially stripped from the sewage effluent with 76 to 90% removal after percolating through 2.74 m of limestone media. Phosphorus breakthrough occurred in the top 0.91 m of limestone after 70l of water loading. The estimated phosphorus adsorption capacity was low at 0.011 kg P/m sup 3. Coliform bacteria removal efficiencies in the sewage runs were >95% at the 0.91 m depth and >99% at the 1.83 m depth. In relation to the limestones' inability to remove nitrogen and phosphorus, the limestone infiltration/percolation system was concluded to be a disposal option and not a treatment alternative.
W81-00641

THE DEVELOPMENT OF CHLORINE RESISTANT ULTRATHIN FILM COMPOSITE MEMBRANES FROM SOLUBLE AROMATIC POLYIMIDE THIN FILMS ON POLYBUTYLENE TEREPHTHALATE SUPPORTS,
Purolator-Puropore, Tustin, CA.
R. E. Kesting, J. M. Newman, A. W. Brewer, and D. M. Tyler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138059, Price codes: A05 in paper copy, A01 in microfiche. Completion Report Prepared for Office of Water Research and Technology, 1980. 71 p, 5 Fig, 14 Tab, 111 Ref. OWRT-C-90298-D(No 9447)(1), 14-34-001-9447.

Descriptors: *Waste treatment, *Chlorination, *Membrane processes, *Reverse osmosis, *Water quality control, *Membranes, Water treatment, Water quality, Liquid wastes, Research and Development, Chemical reactions, Water purfication, Thin films, Filters, Disinfection, Degradation(Decomposition), Sulfur compounds, Sulfonates, Treatment facilities.

Disclosure of the first asymmetric cellulose acetate reverse osmosis (R0) membrane stimulated considerable interest in synthetic polymeric membranes Commercial diaminophenylindane (DAPI) polyimides had specified properties indicative that they could be modified and converted into chlorine-resistant R0 membranes of both integrally skinned (asymmetric) and ultrathin film composite types, but DAPI-based polyamides showed a lack of resistance to degradation by both chlorine and chlorosulfonic acid. New support membranes of poly(butylene terephthalate), PBT, were shown to be resistant to chlorine and most organic solvents, and more wettable than polysulfone membranes. Membranes of PBT may prove an attractive alternative to polysulfone supports, especially if a replacement for the expensive hexafluoroisopropanol solvent can be found. PBT membrane pore size could be controlled by air velocity adjustment above the nascent membrane. Further, it was concluded that sulfonation was generally unsuited for increasing hydrophobic membrane polymer hydrophilicity, and that anionic-exchange type ionogenic R0 membrane polymers were superior to cationic types in both processing and end-use characteristics. Thus, future work will focus on polymers bearing quaternary ammonium groups, rather than sulfonate groups. (Zielinski-IPA)
W81-00679

A VARIABLE-DISCHARGE MODEL FOR FACULTATIVE OXIDATION PONDS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
F. M. Saunders, and E. P. Minchew.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142135, Price codes: A07 in paper copy, A01 in microfiche Environmental Resources Center, Georgia Institute of Technology Report ERC 04-80, June 1980. 122 p, 29 Fig, 7 Tab, 49 Ref, 1 Append. OWRT-A-076-GA(1).

Descriptors: *Mathematical models, *Ponds, *Oxidation lagoons, Discharge frequency, Rural areas, *Waste water treatment, Discharge(Water), Release, Outflow, Water quality control, Streams, Economic feasibility, Water purification, Water

pollution control, Wastes, Permits, Legal aspects, Waste treatment.

Waste water treatment facilities are granted discharge permits based on the ten-year seven-day low flow of the receiving stream; the low value for this parameter requiring that facilities be capable of achieving a high degree of waste water contaminant reduction. The costs associated with supplying a high degree of treatment and the expertise needed to operate such a system are generally lacking in small rural communities. This study demonstrated that a facultative oxidation pond operating according to a variable discharge schedule would be well-suited to rural communities. Lagoon discharge would be reduced to a minimum level during periods of low assimilative capacity of the stream; when the stream could receive heavier wasteloads without water quality degradation below specified standards, the excess lagoon accumulation volume would be gradually released, with the lagoon going through a complete cycle once a year. Such a variable-discharge oxidation pond would provide an economic/technically-feasible alternative for rural communities. The initial implementation cost is significantly lower than that of other processes capable of higher degrees of treatment, and the greater land availablity in rural areas is well-suited to lagoon construction. A field application study of the proposed model was recommended. (Zielinski-IPA)
W81-00680

ENHANCED SOLAR DRYING OF WASTEWATER SLUDGE,
Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.
T. F. Craft.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138034, Price codes: A03 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology Report ERC 05-80, September, 1980. 22 p, 8 Fig, 1 Tab, 7 Ref. OWRT-A-080-GA(1).

Descriptors: *Sludge disposal, *Drying, *Solid wastes, Suspended solids, *Solar distillation, *Waste treatment, Wastes, Sludge treatment, Disposal, Environmental sanitation, Engineering, Engineering structures, Design criteria, Evaluation, Research and Development, Water pollution control, Water pollution, Water purification, Water quality control, Georgia, Efficiencies, Performance.

An increased efficiency was verified experimentally for the drying of anaerobically-digested waste water sludge on a sand bed, using a simple shed roof of translucent corrugated fiberglass. A closed cover designed in the manner of a solar collector and featuring forced ventilation was constructed of light weight materials, and observed for several months prior to destruction by an unprecedented fall of pellet snow. Drying of sludge on suspended screens was shown to be very rapid. Enlargement of this study could provide for fabrication of more substantial covers, each placed on a separate drying bed. The solar-distiller type cover remains the most likely to provide a much-needed efficiency increase in drying beds for waste water sludges. It is possible that a screen arranged as a wide conveyor belt might be periodically loaded at one end and unloaded at the other. If the drying was enhanced by a solar cover or otherwise, a rate as much as four times normal might be achieved, based on the premise of rate-doubling due to enhancement plus exposure of twice as much sludge surface. Further study was recommended to fully evaluate the potential of solar-collector type covers for sludge drying beds. (Zielinski-IPA)
W81-00682

RAPID ASSAYS FOR MICROBIAL DEGRADATION OF 2-CHLOROPHENOL,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemical Engineering.
H. S. Pal, T. Murphy, A. C. Carter, and S. W. Drew.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137929, Price codes: A03 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, Bulletin 128, November, 1980. 31 p, 1 Fig, 5 Tab, 16 Ref. OWRT-B-088-VA(1).

Descriptors: *Chlorinated hydrocarbon pesticides, *Phenols, *Analytical techniques, *Microbial degradation, *Activated sludge, Halogenated pesticides, Organic compounds, Aromatic compounds, Chemical wastes, Chemicals, Industrial wastes, Water pollution, Water pollution sources, Gas chromatography, Cultures, Creosote, Waste treatment, Treatment facilities, Bactericides, Waste water(Pollution).

Standard agar and liquid culture techniques for evaluation of pure/mixed microbial cultures could be modified for estimations of microorganism resistance to and degradation of 2-chlorophenol (2-CP). The modified techniques should be useful in predicting the ability of waste treatment facilities to handle pulsed loads of 2-CP, and may be extended to other toxic compounds. Microorganisms for this study were from activated sludge from the Roanoke, Virginia, sewage treatment plant, and from a soil sample from an area used for creosote-coated lumber storage. The most powerful assay was a modified most-probable-number indicator assay, which allowed correlation of 2-CP resistant and 2-CP degrading subpopulations of a culture by differential reading at 18 and 36 hours. This assay confirmed the expected changed in microbial subpopulations that occur during acclimation of cultures to 2-CP. Determinations of 2-CP and phenol were made by gas chromatographic analysis and a distillation aminoantipyrine condensation-oxidation colorimetric method. The culture assay techniques were used to study shifts in microbial subpopulations identified as sensitive or resistant to the toxic effects of 2-CP. Increased resistance to 2-CP paralleled the increased 2-CP degrading capability of the subpopulations. Rapid and accurate estimation of 2-CP resistance/degradation was possible. (Zielinski-IPA)
W81-00697

FEASIBILITY OF PURIFICATION AND CONCENTRATION OF SELECTED WASTEWATER STREAMS BY ULTRAFILTRATION,
Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.
G. R. Lightsey, and N. Espinoza.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142267, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University Completion Report, October 1980. 31 p, 13 Fig, 7 Tab, 16 Ref. OWRT-A-130-MISS(1), 14-34-0001-0126.

Descriptors: *Filtration, *Water purification, *Waste water treatment, *Membranes, *Industrial wastes, Equipment, Water clarification, Water pollution treatment, Water quality control, Water treatment, Filters, Water quality, Research and development, Wastes, Organic matter, Suspended solids, Chemical oxygen demand, Laboratory tests, Facilities, Feasibility, Project planning.

A laboratory scale study was conducted to determine the feasibility of using ultrafiltration (UF) to purify waste water streams and concentrate the waste contents, for ultimate application to waste water streams such as in pulp/paper mills, hardboard plants, and cheese whey processing plants. Such industries place heavy loads on waste water treatment facilities due to the often significant amounts of high molecular weight organic matter in their waste waters. A batch-type UF process was used to concentrate cheese whey (CW), prehydrolysate (PH), and wood sugars (WS); producing protein, lactose and carbohydrate byproducts while reducing the effluent COD. The system used a commercial batch UF system equipped with Diaflow membranes and having a 2-liter capacity. The CW, PH, and WS were concentrated from 69, 47, and 21 grams/liter to 93, 71, and 60 grams/liter of solids, respectively. During the concentration run, 82, 68, and 88% by volume of the starting feed were recovered in the permeate. The COD reduction of CW, PH, and WS permeates ranged from 92-97% of initial values. Initial COD values of 60,000, 130,000, and 119,000 ppm were reduced to less than 2,000, 6,000, and 9,000 ppm, respectively. Thus, UF determined as an effective process for purification and for organic waste concentration of such waste water streams. (Zielinski-IPA)
W81-00701

SEVENTH ANNUAL REPORT: GREAT LAKES WATER QUALITY.
International Joint Commission, United States and Canada, Windsor (Ontario).
October, 1980. 101 p, 2 Fig, 5 Tab, 3 Append.

Descriptors: *Great Lakes, *Water quality, *International commissions, *Canada, *United States, North America, Bodies of water, Lakes, Great Lakes region, Waste disposal, Waste water(Pollution), Waste treatment, Treatment facilities, Legal aspects, Municipal wastes, Effluents, Industrial wastes, Pollutants, Toxins, Water pollution, Radio-active wastes, Water quality control.

This report marked the transition between the United States/Canada International Joint Commission's activities under the 1972 Great Lakes Water Quality Agreement (GLWQA) and those under the 1978 agreement, and presented an overview and lake-by-lake description of water quality in the Great Lakes Basin during 1978. Problems that arose from industrial/municipal wastes included toxic/hazardous substances and wastes disposal, phosphorous and eutrophication, long-range transport of air-borne pollutants and radioactivity. Topics of Great Lakes surveillance, Commission institutions and new directions under the 1978 Agreement were also covered. The Commission recommended that governments provide a complete inventory of all point source dischargers in the Basin; that improved municipal waste treatment plant efficiency be sought by using optimum operating/maintenance procedures and by upgrading operator skills; that priority be given to complete programs for abatement and control of dischargers of municipal waste waters to the Great Lakes System; and that all jurisdictions use the General and Specific Objectives of the 1978 GLWQA as minimum requirements in granting discharge permits or similar approvals. Governmental sponsoring of an experimental mapping project as also recommended to identify problems/benefits associated with environmental mapping. (Zielinski-IPA)
W81-00702

METHOD FOR BREAKING AN OIL-IN-WATER EMULSION,
Ford Motor Co., Dearborn, MI. (Assignee).
M. H. Weintraub, M. A. Dzieciuch, and R. L. Gealer.
U.S. Patent No 4,194,972, 5 p, 4 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 992, No 4, p 1380, March 25, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Oil pollution, Oily water, Emulsions, Separation techniques, Electrolysis, Oxidation, Foam separation.

A method is disclosed for breaking an oil-in-water emulsion. The method includes the following general steps. A porous ferrous ion producing anode is established. A supply of the oil-in-water emulsion is located on one side of the anode and a fixed volume of the emulsion is flowed through a fixed cross sectional area of the anode per unit of time. Less than a passivating current is flowed through each unit area of the anode per unit of time thereby dissolving into the emulsion ferrous ion in sufficient quantity to break the emulsion. This results in a homogeneous dispersion of the ferrous ions in the fixed volume of the emulsion. There is an in situ generation of hydroxyl ion at the cathode and tiny air bubbles are introduced near the electrodes to oxidize the ferrous ions to ferric ions. The ferric ions are then permitted time to break the emulsion and remove the oil. This oil floats to the top surface in a froth and is removed. (Sinha - OEIS)
W81-00711

METHOD OF LOWERING THE COLOR OF EFFLUENT WHICH CONTAINS ARYL AZO- OR ARLY NITRO-CONTAINING COMPOUNDS,
American Color and Chemical Corp., Charlotte, NC. (Assignee).
R. E. Smith.
U.S. Patent No 4,194,973, 5 p, 12 Ref; Official Gazette of the United States Patent Office, Vol 992, No 4, p 1380, March 25, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Color, Industrial wastes, Chemical reactions, Separation techniques, Metals, Bactericides.

Effluent which contains aryl azo- and/or aryl nitro-containing compounds is treated to remove the color by contacting the effluent with Fe(II) in the presence of iron at a temperature and for a time sufficient to cause reduction of the aryl azo and aryl nitro groups of the effluent. Effluent containing metallized compounds may be treated in the same manner and then subjected to alkaline neutralization to remove the metal from the effluent. (Sinha -OEIS)
W81-00712

KRAFT PULP BLEACHING AND RECOVERY PROCESS,
Scott Paper Co., Philadelphia, PA. (Assignee).
R. P. Singh.
U.S. Patent No 4,196,043, 4 p, 12 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 233, April 1, 1980.

Descriptors: *Patents, *Waste water treatment, Water pollution, Industrial wastes, Bleaching wastes, Pulp and paper industry, Recirculated water, Water reuse, Water utilization, Chemical recovery.

In this invention Kraft pulp is bleached to a high brightness by a bleaching sequence comprising from one to about three treatments with ozone, and a final treatment with an alkaline peroxide solution, the bleach treatments being separated by an alkaline extraction. The effluent from each of the bleach treatments is collected and either, recycled and utilized in subsequent bleaching operations thereby reducing the amount of fresh water required, or introduced into the chemical recovery system of a Kraft pulping process thereby eliminating pollution which would otherwise be caused by dumping these effluents. (Sinha - OEIS)
W81-00718

SEWAGE TREATMENT,
BOC Ltd., London (England). (Assignee).
M. E. Garrett, and K. C. Smith.
U.S. Patent No 4,196,074, 4 p, 2 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 241, April 1, 1980.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Oxygenation, Sewers, Water pollution treatment, Equipment.

In order to reduce the likelihood of the formation of hydrogen sulphide in the sewer and to reduce the amount of further treatment required to be carried out on sewage, oxygen containing gas is dissolved in sewage passing to, or through, a sewer during periods of pumping. A stream of the sewage is withdrawn during periods when sewage is being held in the sewer. This stream is passed through a conduit so as to promote dissolution of oxygen-containing gas introduced into, or entrained in, the stream. The stream is then returned to the sewer. By this means a chosen concentration of dissolved oxygen may be maintained in the volume of sewage between the points of withdrawal and return of the stream. (Sinha - OEIS)
W81-00719

PROCESS AND APPARATUS FOR DEWATERING GRANULATED MATERIAL, ESPECIALLY GRANULATED BLAST FURNACE SLAG,
For primary bibliographic entry see Field 3E.
W81-00720

PLEATED FILTER UNDERDRAIN, METHOD AND APPARATUS,
Harsco Corp., Wormleysburg, Pa. (Assignee).
For primary bibliographic entry see Field 5G.
W81-00721

COMBINATION OF A BIOLOGICAL DRY TOILET AND A BIOLOGICAL WASTE WATER PURIFYING PLANT,
Asko-Upo Oy, Lahti (Finland). (Assignee); and AGA Heating A. B., Geoteborg (Sweden). (Assignee).
T. T. Salokangas, U. T. Lammi, and T. J. Miettinen.
U.S. Patent No 4,196,082, 4 p, 1 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 244, April 1, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Biological treatment, Domestic wastes, Soil disposal fields, Filtration, Equipment, Dry toilets.

In a combination of a biological dry toilet and a biological waste water purifying plant the heat and coarse sludge of the so called grey water from households is recovered in the dry toilet to which also the fine sludge from the waste water purifying plant is pumped. The heat obtained is used for heating the compost and both sludges collected in the filters are from time to time combined to compost them together with the other waste in the dry toilet. A suction fan in the dry toilet also sucks the air needed by the biofilter through the filter bed. The purified water obtained from the waste water purifying plant is absorbed in the soil. (Sinha-OEIS)
W81-00723

THE EFFECT OF DISSOLVED OXYGEN CONCENTRATION ON NITRIFICATION,
California Univ., Los Angeles. School of Engineering and Applied Science.
M. K. Stenstrom, and R. A. Poduska.
Water Research, Vol 14, No 6, p 643-649, June, 1980. 3 Fig, 1 Tab, 50 Ref.

Descriptors: *Dissolved oxygen, *Nitrification, *Kinetics, *Reviews, *Biological treatment, Aquatic bacteria, Waste water treatment, Sewage bacteria, Sewage treatment, Activated sludge, Retention, Laboratory tests, Diffusion, Flocculation, Theoretical analysis, Variability, Natural streams, Aeration, Rates.

A review of the literature on the effects of dissolved oxygen (D0) levels on the rate of nitrification is presented, and the mechanisms which could be responsible for the variability in the reported findings are evaluated. Research has been conducted in both pure and mixed cultures and in cultures isolated from wastewater treatment systems. Data from all sources indicate that the maximum growth rates of nitrification reactions are affected by D0 levels over the range of 0.3 milligrams/liter to as much as 4.0 milligrams/liter. Conflicting results arise from studies revealing D0 levels of 4.0 milligrams/liter for maximum nitrification rates, while other experiments show achievement of maximum nitrification rates at only 0.5 to 1.0 milligram/liter of D0. These variations in results have been attributed to the effects of oxygen diffusion in flocs, differences in measure results due to steady-state and dynamic measuring methods, and epecially double-substrate limited kinetics. (Geiger-FRC)
W81-00729

A COMPARISON OF MODELS FOR COMPLETELY MIXED ACTIVATED SLUDGE TREATMENT DESIGN AND OPERATION,
Centre Belge d'Etude et de Documentation des Eaux, Liege.
L. Vandevenne, and W. W. Eckenfelder, Jr.
Water Research, Vol 14, No 6, p 561-566, June, 1980. 6 Fig, 25 Ref.

Descriptors: *Activated sludge, *Sludge treatment, *Design, *Mathematical models, *Essential nutrients, Organic matter, Wastes, Suspended solids, Physical properties.

Two models for completely mixed activated sludge treatment design and operation are compared. With the exception of the varible for influent substrate concentration, they are similar in concept. Both the McKinney, Eckenfelder model and the Lawrence, McCarty model incorporate substrate removal, effect of initial substrate concentration, and nutrient requirements. A statistical analysis of performance data for both models showed a slightly better correlation coefficient for the Eckenfelder model, which includes the variable for influent substrate concentration. This variable is significant in determining the retention time necessary to achieve removal of biochemical oxygen demand and to maintain food/microorganism ratios. It may affect design considerations for industrial wastewater treatment facilities. However, more research is necessary to determine the significance of influent substrate concentration on the removal rate in most activatd sludge processes. (Titus-FRC)
W81-00730

CONCENTRATION OF IMPURITIES BY PROGRESSIVE FREEZING,
Chalmers Univ. of Technology, Geoteborg (Sweden). Dept. of Chemical Engineering Design
R. Halde.
Water Research, Vol 14, No 6, p 575-580, June, 1980. 9 Fig, 10 Ref.

Descriptors: *Water purification, *Solutes, *Ice, Freeze-thaw tests, Crystallization, Laboratory tests, Ice-water interfaces, Wastes, Suspended load, Temperature, Desalination processes, Sludge treatment.

The method of purifying water by freezing is discussed. It is based on the fact that ice crystals built up from aqueous solutions are composed of pure water, while impurities remain in liquid state. Thus, it has application for concentating wastes and for desalination. Experimentation with freezing rate, applied shear forces and added chemicals reveals that each affects impurity migration. Intense stirring of the liquid phase provides for higher degrees of purification. Purfication is slightly increased by increased rate of freezing. Particles greater than .000005 m in size are more easily separated. In application to sludge, it was found that raw and dewatered sludge can produce an impurity concentration less than .03%, while thickened, digested sludge diluted with pure water rendered the best separation, due to reduced particle size. The addition of a polymer to the liquid phase improved migration during freezing. (Titus-FRC)
W81-00731

CHARACTERISTIC EVALUATION OF TRICKLING FILTER PROCESS,
Tokyo Inst. of Tech. (Japan). Research Lab. of Resources Utilization.
Y. Hosono, H. Kubota, and Y. Miyaji.
Water Research, Vol 14, No 6, p 581-590, June, 1980. 16 Fig, 4 Tab, 23 Ref.

Descriptors: *Trickling filters, *Waste water treatment, *Numerical analysis, Filters, Flow rates, Biochemical oxygen demand, Equipment, Water quality control, Equations, Temperature, Microorganisms, Hydraulics.

A method is proposed for prediction of the biochemical oxygen demand removed from wastewater in the trickling filter process. The method involves calculations dependent on type of media, surface area of the filter bed, superficial liquid flow rate and influent biochemical oxygen demand. Operating conditions of both standard and high-rate trickling filters for wastewater were experimentally determined. Results indicate that higher fractions of biochemical oxygen demand removal are obtained with increased liquid recycle ratios. Power economy, defined as removal rate per unit power consumption, decreases significantly with increased loading of the filter. Standard trickling filters with a liquid recycling ratio of 0 give higher power economy values at lower loadings, while high-rate filters with a higher ratio are advantageous at higher loadings. The absolute values of power economy are relatively low in

comparison with the activated sludge process. (Titus-FRC)
W81-00732

BIODEGRADABILITY DETERMINATIONS IN TRICKLING FILTER UNITS COMPARED WITH THE OECD CONFIRMATORY TEST,
Henkel KGaA, Duesseldorf (Germany, F. R.). Dept. of Ecology.
P. Gerike, W. K. Fischer, and W. Holtmann.
Water Research, Vol 14, No 7, p 753-758, July 1980. 1 Fig, 1 Tab, 7 Ref.

Descriptors: *Analytical techniques, *Biodegradation, *Trickling filters, *Testing procedures, Mathematical studies, Carbon, Activated sludge, *Sewage treatment, Laboratory tests, Settling basins, Sewage bacteria, Biological treatment.

The sensitivity, reproducibility, and tolerance limits as well as the advantages and problems of the coupled units test, a modified version of the OECD Confirmatory Test, were examined. The method has been applied to trickling filters with square wave feeding tests and a new transinoculation procedure. Reproducibility of the method for determining the biodegradability of environmental chemicals is generally good. The COD and DOC removals for various compounds in the coupled units test were investigated. Tolerance limits width was found to be dependent upon the number of determinations and the test concentration. Due to the success of transinoculation in the trickling filters accomplished by the simple exchange of effluents from the test and parallel units, the same procedure was tried in the conventional coupled units test in the OECD Confirmatory Test by exchanging liquid out of the settling tank rather than out of the activated sludge vessel. The advantage of this step was that no material adsorbed on the sludge could be transferred from the test unit to the parallel unit in the transinoculation procedure. The two major contributors to the tolerance limits were analytical and biological variance. Mathematical studies offered clues for improving the method. (Geiger-FRC)
W81-00735

ON FARM AEROBIC TREATMENT OF PIGGERY WASTE. THE EFFECT OF RESIDENCE TIME AND STORAGE ON EFFLUENT QUALITY,
North of Scotland Coll. of Agriculture, Aberdeen (Scotland).
D. R. Fenlon, and P. J. Mills.
Water Research, Vol 14, No 7, p 805-808, July, 1980. 4 Tab, 14 Ref.

Descriptors: *Farm wastes, *Aerobic treatment, *Livestock, *Organic wastes, Effluents, Water quality, Chemical oxidation demand, Waste disposal, Feedlots, Denitrification, Suspended solids, Farm lagoons.

A description of the effect of reducing the residence time of screened pig slurry in a pilot scale oxidation ditch is presented. The soluble organic fraction was significantly reduced by conversion to suspended solids and organic nitrogen at reduced residence times and by mineralization at long residence times. Desorption and denitrification caused high losses of inorganic nitrogen during the treatment process. A laboratory system using the same waste at a controlled loading rate demonstrated that the amount of oxygen demand lost per day was constant, and confirmed that the residence time determined whether mineralization or solids production occurred. Over-winter storage of aerobically treated waste resulted in a small increase in soluble COD; however, it remained far more acceptable for land disposal than untreated material. (McKeon-FRC)
W81-00738

EFFLUENT TREATMENT AND ALGAE RECOVERY BY OZONE-INDUCED FLOTATION,
Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
N. Betzer, Y. Argaman, and Y. Kott.
Water Research, Vol 14, No 8, p 1003-1009, August, 1980. 7 Fig, 4 Tab, 14 Ref.

Descriptors: *Ozone, *Oxidation lagoons, *Flotation, *Water purification, *Algae, Waste water treatment, Coliforms, Separation techniques, Foaming, Frothing, Sewage treatment, Suspended solids.

In studies concerned with disinfection of stabilization ponds effluents, algal separation by ozone-induced flotation was observed. In the present study, the practical application of this phenomena was investigated on a bench-scale flotation column using oxygen enriched with ozone. A clear colorless liquid resulted from the process with over 98% removal of suspended solids. Fecal coliforms were reduced up to three orders of magnitude by the process. Usual ozone dosages required ranged from 15 to 50 mg/liter. The froth that resulted thickened to form a pure algal mass composed of 8.5% solids. The reaction of ozone with algal cells was shown to form a hydrophobic surface which could be separated by bubbling. The thickened algal froth formed a valuable product. Liquid effluents could then be disinfected without formation of hazardous chlorinated organics. The process offers an attractive approach to waste-water treatment under certain circumstances. (Geiger-FRC)
W81-00744

EVALUATION OF OZONE INDUCED BIODEGRADABILITY OF WASTEWATER TREATMENT PLANT EFFLUENT,
Technion - Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
N. Narkis, and M. Schneider-Rotel.
Water Research, Vol 14, No 8, p 929-939, August, 1980. 13 Fig, 3 Tab, 12 Ref.

Descriptors: *Biodegradation, *Ozone, *Sewage effluents, Biological treatment, *Waste water treatment, Lime, Sewage bacteria, Organic wastes, Oxidation, Costs, Pilot plants, Hydrogen ion concentration.

A method was tested for the quantitative determination of biodegradability induced by ozone on refractory organic matter in solution after conventional treatment of wastewater by biological methods and by lime. The long-term BOD test is suitable for aqueous solutions with relatively low levels of organic matter. Seeding of water samples with bacteria was accomplished with filtered effluent of biological treatment plants. COD, total organic carbon, BOD, and dissolved oxygen were measured, as well as nitrification, pH, and changes in bacterial populations. An improvement in biodegradability was found in ozonated samples and was attributed to the removal of inhibitory effects due to changes in molecular structure. Acclimation of ozonated effluents was required in all biodegradability tests. A combination of lime treatment and high pH (11.8) enhanced biodegradability, an effect which was not observed with lime treatment alone. It was suggested that the ozone levels used in these pilot studies were too high to be cost efficient, although they were more than adequate for increasing the level of biodegradability in wastewater effluents. (Geiger-FRC)
W81-00746

5E. Ultimate Disposal Of Wastes

THE SURVIVAL OF SALMONELLAE IN SEWAGE SLUDGE APPLIED TO ARABLE LAND,
North West Water Authority, Warrington (England). Western Div.
D. C. Watson.
Water Pollution Control, Vol 79, No 1, 11-18, 1980. 3 Fig, 3 Tab, 16 Ref.

Descriptors: *Arable land, *Salmonella, *Sewage sludge, Sewage disposal, Ultimate disposal, Spraying, Soil types, Sands, Organic soils, Organic wastes, Sludge digestion, Sludge disposal, Air temperature, Domestic wastes.

The survival of salmonella in sewage sludge applied to arable land in England was investigated. Sludge was mainly of domestic sewage origin and underwent mesophilic digestion which removed 85-95% of salmonella. The digested sludge, containing about 64% organic wastes, was applied at 70 cu m/ha by spraying. Samples of soil and sludge were taken on application, and soil/sludge samples were taken weekly for 10 wk thereafter. The experiment was conducted in April-July 1976 (a hot, dry period) on sandy soil and in May-July 1977 (typical climate) on a similar soil and on a heavier soil containing more organic matter. On application, the sludge contained 300 and 250 salmonella/kg on wet weight in 1976 and 1977, respectively. Numbers of salmonella/kg in the soil/sludge ranged from 0 (wk 7, 8 and 9) to 160 (1 wk) in 1976 and from 0 (wks 6, 8, and 9) to 35 (wk 1) in 1977. Factors affecting salmonella survival in the environment are its physical state, availability of organic matter, environmental temperature (greater survival at 1-5C than at 10-15C), moisture content of surrounding material (they are susceptible to desiccation), pH of soil, rainfall, and sunshine. The logarithmic die-off of the organisms (T90) was similar for both years for the sandy soil (3.6), though that for the heavier soil was 3.0. It is postulated that the variation in T90 between soils was due to numbers originally present or to the nature of the soil. The survival period of salmonella was about 6 wk, but this is dependent on the numbers originally present in sludge and on environmental conditions. (Just-FRC)
W81-00572

WANT NOT, WASTE NOT. SENSIBLE SLUDGE RECYCLING,
Department of the Environment, London (England). Water Engineering.
R. Best.
Water Pollution Control, Vol 79, No 2, p 307-321, 1980. 9 Fig, 1 Append.

Descriptors: *Sludge disposal, *Sewage sludge, *Recycling, *Environmental effects, Cost-benefit analysis, Public health, Waste water treatment, Environmental sanitation, Nutrients, Heavy metals, Incineration, Land management, Organic wastes, Microorganisms, Sludge treatment.

The Chairman of the Department of the Environment's (U.K.) Standing Committee on the Disposal of Sewage Sluge offers his personal approach to sludge disposal in the waste water cleaning process. The safe, effective and economic disposal of sewage sludge is one of the most challenging aspects of waste water disposal. Knowledge of the characteristics of sewage sludge is essential in understanding its handling and disposal. Sludge may contain particulate matter, free water (about 70%), capillary water (2%), floc water (20%) and intracellular water (8%) by some definitions, although the characteristics of a sludge may vary considerably. Objectives for sludge disposal must be clearly defined, and acceptable residual risks must also be taken into account, and recycling of sludge material must be a priority. Substances targeted for reuse or recovery from sludge material include organic matter, nutrients, trace substances, heavy metals, graded mineral particles, and pathogens. Unrecoverable material is usually returned to land via spreading from tankers or spraying from pipes or is discharged to water bodies. Harmful sludge is usually incinerated. New attitudes towards sludge reuse in the future may require reeducation. A discussion follows the article. (Geiger-FRC)
W81-00585

THE DEWATERING OF ACTIVATED SLUDGE: MEASUREMENT OF SPECIFIC RESISTANCE TO FILTRATION AND CAPILLARY SUCTION TIME,
Commonwealth Scientific and Industrial Research Organization, Rockhampton (Australia). Meat Research Lab.
B. V. Kavanagh.
Water Pollution Control, Vol 79, No 3, p 388-398, 1980. 7 Fig, 17 Ref.

Descriptors: *Dewatering, *Activated sludge, *Flow resistance, *Filtration, Waste treatment, Sludge, Regression analysis, Hydraulics, Mathematical models, Sludge treatment, Resistance, Capillary action.

The results of an experimental study aimed at critically assessing the validity of the basic filtration equation developed by Carman in describing the filtration of activatd sludges are presented. The study indicated that with the exception off the role of pressure, the basic filtration equation can be used quanitatively to describe the filtration of biological sludges. The measurement of specific resistance to filtration (SRF) represents the best defined laboratory measurement of sludge dewaterablity currently available. This and other studies also indicated that capillary suction time (CST) measurements are a useful measure of sludge filterability and can be directly related to SRF measurements. The functional dependence of CST measurements on variables such as solids concentration and viscosity is consistent with that expected on the basis of theoretical considerations. It is suggested that an operating pressure of 49.1 kPa (368 mm Hg) be made the standard value for use in the determination of the SRF of biological sludges. (McKeon-FRC)
W81-00613

DISPOSAL OF SEWAGE SLUDGE TO LAND: CHEMICAL AND MICROBIOLOGICAL ASPECT OF SLUDGE TO LAND POLICY,
Yorkshire Water Authority (England). Office of Scientific Services.
J. A. Hudson, and H. Fennel.
Water Pollution Control, Vol 79, No 3, p 370-387, 1980. 33 Ref.

Descriptors: *Sludge disposal, *Land management, *Toxins, *Soil contamination, *Public health, Sewage sludge, Sludge treatment, Nutrients, Cultivation, Heavy metals, Incineration, Pesticide residues, Fertilizers, Organic matter, Lead, Industrial wastes, Animal parasites, Microorganisms, Zinc, Cadmium, Recycling.

The spreading of sewage sludge on farm land poses the problems of adding toxic metals to the soil and spreading organisms that are pathogenic in man and animals. Toxic metals may find their way into farmland soil not only from sewage sludge deposition but from other industrial effluents, by fertilizers, ameliorants, pesticides, or by motor exhaust fumes, pig slurry, or composted refuse. Sampling of farmland soils for analyses for heavy metals was conducted by the Soil Science Laboratories at Leeds, England. Of 210 fields sampled, 16 were considered to be contaminated with zinc (> 250 mg/kg), but it was not certain this was due to sludge disposal. Analyses for cadmium and lead in the Leeds area showed that neither metal was present in quantities that would be toxic according to current standards. Studies have shown that factors such as soil properties, plant species and cultivation practices may influence the amount of metals available to the soil from sewage sludges. Sludges from the Yorkshire area containing toxic levels of heavy metals are incinerated. Addition of sludge to farmland may be beneficial if the sludge contains sufficient nutrients to replace the use of organic fertilizers. Methods are presented for calculating safe field application rates for zinc from sludge to farmlands. An evaluation of the kinetics of microorganisms and beef and pork tapeworm from sewage sludge to farmlands to man and animals is presented. What happens to these organisms during sewage treatment and during sludge application to land is described along with their movement by water courses and underground water sources. A discussion follows the article. (Geiger-FRC)
W81-00615

METHODS FOR THE ISOLATION OF VIRUS FROM RAW AND DIGESTED WASTEWATER SLUDGE,
Royal Veterinary and Agricultural Univ., Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
For primary bibliographic entry see Field 5G.
W81-00632

RVRFLO: A HYDRAULIC SIMULATOR OF WATER QUALITY IN THE HOUSATONIC RIVER IN CONNECTICUT,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 5B.
W81-00651

METHOD FOR STORING WASTE MATERIALS AND THEIR COMBUSTION RESIDUES IN A MANNER HARMLESS TO UNDERGROUND WATER,
H. Egger.
U.S. Patent No 4,194,855, 5 p, 1 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 992, No 4, p 1341-1342, March 25, 1980.

Descriptors: *Patents, *Waste storage, *Waste disposal, Underground waste disposal, Subsurface waters, Linings, Sealants, Industrial wastes.

An earth pit is prepared for the storage of waste materials by lining the bottom of the pit with a layer of finely-ground loose material followed by a synthetic plastic sheet resistant to humas, roots and tearing followed by a second layer of finely-ground loose material. The layers of loose material equalize the pressure on the opposite sides of the synthetic plastic sheet. A number of sheets may be solution-welded together for a large pit. A further important property which the sheet should possess is chemical resistance, in particular, resistance to alkali. Particularly suitable for the purposes of the invention are suitably stabilized PVC sheets, in particular, those stabilized with barium/cadmium compounds. (Sinha-OEIS)
W81-00710

5F. Water Treatment and Quality Alteration

DIRECT FILTRATION OF VIRGINIA SURFACE WATERS: FEASIBILITY AND COSTS,
West Virginia Inst. of Tech., Montgomery. Dept. of Civil Engineering.
R. F. McCormick, and P. H. King.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127391, Price codes: A06 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Bulletin 129, November 1980. 99 p, 21 Fig, 26 Tab, 40 Ref. OWRT A-081-VA(1).

Descriptors: *Virginia, *Surface waters, *Water supply, *Water treatment, *Filtration, Economics, Feasibility studies, Costs, Filters, Design(Filters).

This research investigated the technical and economic feasibility of the direct filtration technique for treating high-quality Virginia surface waters prior to domestic use. One of the flow schemes that was investigated eliminates the sedimentation basin while employing a full, conventional flocculation period. Another eliminates separate sedimentation and flocculation units altogether. Major variables that were assessed in terms of their effects on direct filtration performances included raw water characteristics such as turbidity, color, total dissolved solids, total hardness, algae count, and total coliform count; filter design variables such as type and size of media (two dual media filters and one trimedia were evaluated); and operating variables such as hydraulic loading rate and nature and dosage of applied coagulant. The most effective filtration scheme consisted of a three minute rapid mix with alum and cationic polymer as primary coagulants, followed by filtration at a 5 gallons per minute/sq ft loading rate through 20 inches of 1.3-mm effective size anthracite coal and 10 inches of 0.45-mm effective size silica sand. Color and algae concentrations had definite effects upon the direct filtration process. Results from the study show that raw waters with turbidities less than 10 NTU, color less than 15 APHA units, and algae concentrations less than about 1,000 colonies/ml should be excellent candidates for economical treatment by direct filtration.
W81-00501

FLUSHING SYSTEM FOR REVERSE OSMOSIS WATER PURIFICATION UNITS,
W. A. Parkinson.
U.S. Patent No 4,193,872, 5 p, 2 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 1004, March 18, 1980.

Descriptors: *Patents, *Water treatment, *Water purification, Separation techniques, *Reverse osmosis, Domestic water, Membranes, Flushing.

A reverse osmosis water purification system for home usage is flushed periodically automatically by actuation of a non-related apparatus. In one embodiment, the reverse osmosis cartridge is mounted directly in the cold water line to a sink, so that water passes through the cold water inlet through the contaminated water outlet to the cold water faucet to the sink, flushing contaminants out of the cartridge through the faucet when the faucet is opened. In another embodiment, flushing is actuated by a solenoid-operated valve electrically connected to a garbage disposal switch. (Sinha - OEIS)
W81-00525

THE EFFECTS OF PERMANGANATE PRETREATMENT ON TRIHALOMETHANE FORMATION IN DRINKING WATER,
North Carolina Univ. at Chapel Hill.
P. C. Singer, J. H. Borchardt, and J. M. Colthurst.
Journal of the American Water Works Association, Vol 72, No 10, p 573-578, October, 1980. 11 Fig, 8 Ref.

Descriptors: *Chlorination, *Water treatment, *Organic compounds, Disinfection, Surface waters, Halogens, Potable water, Oxidation, Water pollution, Permanganate.

The effects of permanganate pretreatment on trihalomethane formation in drinking water were examined in water samples collected from the surface waters of Chapel Hill and Durham, North Carolina. Samples were treated with permanganate with a controlled quenching procedure to minimize the addition of excess sulfite. Quenched samples were filtered to remove manganese dioxide and then were stored until chlorination. Chlorine was added at pH 7 and sample bottles were sealed. Aliquots were sampled from each bottle and titrated amperometrically with PAO to determine the residual free chlorine concentration. Permanganate had a relatively minor effect on the subsequent chlorine demand of the water. Permanganate reactivity in the water was found to be a function of raw water quality, pH and permangante dose. The chloroform formation potential of water samples was decreased by permanganate treatment in a manner which was proportional to the amount of permangante consumed after the immediate oxidant demand of the water was met. Permanganate had little effect on chloroform production when used at the doses typically employed for water pretreatment. Larger doses would be required to reduce the formation of trihalomethanes in practice. When permanganate is used for oxidative pretreatment purposes, chlorine may be added as a post-treatment procedure after filtration so that chlorine is added to a cleaner water with fewer precursorsof trihalomethane. (Geiger-FRC)
W81-00570

DRINKING WATER CHLORINATION: A PRACTICE UNRELATED TO CANCER MORTALITY,
Massachusetts Univ., Amherst. Dept. of Environmental Health.
R. W. Tuthill, and G. S. Moore.
Journal of the American Water Works Association, Vol 72, No 10, p 570-573, October, 1980. 1 Fig, 2 Tab, 27 Ref.

Descriptors: *Potable water, *Chlorination, *Cancer, Human diseases, Public health, Disinfection, Water purification, Toxicity, Epidemiology, Massachusetts, Social aspects.

The charge that chlorination of drinking water has been linked positively to increased incidence of cancer of the stomach and rectum has been reevaluated. Massachusetts communities having public water supplied from surface sources in 1949 whose

population growth did not exceed 25% between 1950-1970 were investigated. Measurements were made of the average chlorine dose used in the past, recent trihalomethane levels in the water, and recent doses of chlorine. Cancer mortality data from 1969 to 1976 was used. U.S. census records supplied sociodemographic information for each community, including median family income, educational level, percent of nonwhite and foreign-born residents, and percent population change. The data indicated that the initially significant correlations between the levels of trihalomethanes in drinking water and incidence of colon or rectal cancer disappeared after controlling for ethnicity in the first case and foreign-born residents in the latter case. It is suggested that studies linking stomach and rectal cancer to chlorination of drinking water may have been premature in that they did not include socioeconomic variables in their analyses. (Baker-FRC)
W81-00592

AN EMPIRICAL KINETIC MODEL OF TRIHALOMETHANE FORMATION: APPLICATIONS TO MEET THE PROPOSED THM STANDARD,
Montgomery (James M.), Inc., Pasadena, CA.
M. C. Kavanaugh, A. R. Trussell, J. Cromer, and R. R. Trussell.
Journal of the American Water Works Association, Vol 72, No 10, p 578-582, October, 1980. 11 Fig, 22 Ref.

Descriptors: *Potable water, *Chlorination, *Model studies, *Water pollution sources, *Organic compounds, Disinfection, Bromides, Surface waters, Ammonia, Nitrogen compounds, Water treatment, coagulation, Water purification, Organic loading, Standards, Chemical reactions.

When a chlorine is used for disinfection of drinking water, the approach to the reduction of trihalomethane (THM) production has been to reduce the potential for formation of THM prior to chlorination or to remove THM after formation. Due to the complexity of the reactions of chlorine with other organic molecules in water, few kinetic models of THM formation have been formulated. The present study presents a semiempirical reaction rate model for THM formation based on the overall reaction stoichiometry. THM formation is described by a single-rate expression, and an analytical framework for evaluating the THM formation potential in water is provided. The model, which is still in the developmental stage, is a two-parameter kinetic model that allows estimation of the acceptable effluent total organic content (TOC) that must be achieved. Coagulation or GAC adsorption are used when chlorine is applied as a postdisinfectant. Optimum coagulation and reduced chlorine dose will ensure that proposed standards of 100 micrograms/liter total THM are met in surface waters with TOC values of 3-4 milligrams/liter and low bromide levels. The dependence of the THM formation rate on the applied chlorine dose as well as the effect of bromide, ammonia and organic nitrogen indicate that a standard procedure for estimating THM formation potential in a water supply would be difficult to achieve. (Geiger-FRC)
W81-00596

REBUILDING LENGTHENS FILTER RUNS FOR ALGAE-PLAGUED UTILITY,
Gary-Hobart Water Corp., Gary, IN.
K. Young.
American City and County, Vol 95, No 6, p 40-41, June, 1980. 1 Fig.

Descriptors: *Filters, *Potable water, *Algae, Diatoms, Sands, Coals, Turbidity, Costs, Municipal water, Water purification, Water treatment.

Sand filters with a 2-3 gpm/sq ft filtration rate were designed to improve water quality in the Gary, Iniana drinking water supply system. However, filter runs soon dropped from 35-40 hr to as little as 3 hr during the summer's high filtration rates due to an abundance of algae, predominatly diatoms. As a solution to the problem, 6-inch caps of 0.85- to 0.90-mm anthracite were placed on four of the six filters. One filter was converted to a dual media bed of sand (6 inches) and anthracite (18 inches), while the sixth remained as a control sand filter. Four turbidimeters were installed to monitor the water and the filters. The performance of the dual media filter was equal to that of the capped filter, and the former was capable of storing greater quantities of tubidity at a low head loss. These two types of filter performed as well or better than the sand filter and allowed filter runs to double or triple. All filters were also checked for gravel mounding. Since that tie, the filters have been rebuilt to incorporate the dual media design at a rate of one a year. Filter runs now average 70-80 hr during summer high pumpage periods and the amount of wash water needed has been reduced. Costs have also been reduced. However, the deep anthracite bed and the polyelectrolyte addition requires a longer wash to break up the heavy floc and move it up and out of the filter. (Baker-FRC)
W81-00606

INDUSTRIAL SURCHARGES THAT INDUSTRY LIKES,
Burgess and Niple Ltd., Columbus, OH.
H. R. Stonerook, and R. E. Birkbeck.
American City and County, Vol 95, No 5, p 63-65, May, 1980. 2 Fig, 1 Tab.

Descriptors: *Municipal water, *Industrial wastes, *Water rates, Prices, Food processing industry, Water pollution sources, Waste water treatment, Monitoring, Costs, Biochemical oxygen demand, Sewage treatment, Inflow, Legislation.

Orrville, Ohio (population 7,850) has enacted an ambitious industrial monitoring program which allows fair distribution of the costs involved in treating polluted water. About 70% of the city's waste water treatment revenue comes from nondomestic users of the water supply. Orrville contains 23 major industrial plants and processes and sanitizes waste streams from all but one of these plants. Four of the plants are food processors, contributing 24% of the flow and 70% of the BOD to the city treatment facility. In June 1972, legislation was passed which required industries to establish flow monitoring and sampling stations within one year. When some industries did not comply, the city monitored their discharges and billed the companies for water usage accordingly. The waste water treatment plant demonstrates erratic flow behavior due to changes in industial processes. Average peak-month BOD loads have exceeded 10,000 lb/day. Peak-day influent BOD loads regularly exceeded 10,000 lb/day and were observed to be as high as 19,114 lb/day. Flow equalization, which improves flexibiltiy, is achieved by regulating the amount of sewage pumped through the treatment plant and surcharging the influent trunk sewer. Food processing industries are assessed a surcharge of $0.1231/lb of contributed BOD and $0.0568/100 gal of process waste. (Baker-FRC)
W81-00607

IMPROVED METHOD GENERATES MORE CHLORINE DIOXIDE,
Penwalt Corp., Belleville, NJ. Wallace and Tiernan Div.
R. W. Jordon, A. J. Kosinski, and R. J. Baker.
Water and Sewage Works, Vol 127, No 10, p 44-45, October, 1980. 5 Fig, 9 Ref.

Descriptors: *Chlorination, *Water treatment, *Laboratory test, *Chemical reactions, Chlorine, Disinfection, Odor, Volumetric analysis, Spectrophotometry, Costs, Hydrogen ion concentration, Acidity.

The use of hydrochloric acid in the generation of chlorine dioxide as an alternative to chlorine for water disinfection is discussed. Chlorine dioxide is generated from sodium chlorite and chlorine. Tests have established that in small cost-effective doses (0.1 mole H(+) (HCl) per mole sodium chloride), hydrochloric acid produces a yield greater than 90% using no excess chlorine. Unreacted chlorine and unreacted sodium chlorite in the product stream are reduced, improving both yield and purity. With hydrochloric acid, the generating apparatus requires accurate metering, interlocks to prevent the combination of strong chemical solutions, and special consideration for backpressure at the point of application of the chlorinator injector. Laboratory tests were performed using three methods to check the experimental yields of chlorine dioxide. Titration and spectrophotometry produced good agreement at 360 nm. Purity could not be tested because chlorine and chlorite are mutual interferences in spectrophotometric analyses. Good agreement was also obtained at 260 nm between titration and operation of the apparatus without the chlorinator. Hydrochloric acid is in limited use in Europe and provides more economy for extensive use in taste-and-odor control and the oxidation of manganese. (Titus-FRC)
W81-00610

DESIGN OF BIOLOGICAL FILTRATION PLANTS,
Water Research Centre, Stevenage (England).
G. Hoyland, and N. J. Harwood.
Water Pollution Control, Vol 79, No 3, p 352-269, 1980. 12 Fig, 1 Tab, 19 Ref.

Descriptors: *Mathematical models, *Design, *Trickling filters, *Sewage treatment, *Biological treatment, Suspended solids, Biochemical oxygen demand, Optimization, Economics, Costs, Filtration, Capital costs, Operating costs, Settling basins.

Mathematical models were devised to optimize the capacities of primary sedimentation and biologcial filtration to minimize the overall cost of treatment. Optimization was carried out for two hypothetical works with single biological filtration serving populations. of 10,000 and 100,000, the average daily flow of sewage per person being 200 liters. Derivations are described in detail. The total costs of biological filtration works treating sewage to a 25 mg/liter suspended solids/15 mg/liter BOD standard were minimized to determine optimum design. Optimization was based on capital and operating costs and on performance relations derived from primary sedimentation and secondary treatment. The empirical performance relationships for primary sedimentation predict the average composition of settled sewage for overflow rates of 0.5-6.0 m/hr and influent suspended solids concentrations of 200-1,000 mg/liter. A comparison of total annual costs of filters with equal interfacial area showed that a small random plastic medium having an effective surface area of 200 sq. m/cu m may be more economical than a stone medium having an area of 100 sq m/cu m. The optimization suggested that the total cost of treatment was minimized at works where the retention period in primary sedimentation tanks was low, especially at the works where sludge-treatment costs were high. Discussions follow this paper.(McKeon-FRC)
W81-00616

FIELD EXPERIMENTS ON APPLICATION OF TREATED MUNICIPAL WASTE WATERS TO VEGETATED LANDS,
Tehran Univ. (Iran).
For primary bibliographic entry see Field 3C.
W81-00620

CHARACTERIZATION AND ACTIVATED CARBON ADSORPTION OF SEVERAL HUMIC SUBSTANCES,
Illinois Univ., Urbana-Champaign. Dept of Civil Engineering.
J. J. McCreary, and V. L. Snoeyink.
Water Research, Vol 14, No 2, p 151-160, February, 1980. 9 Fig, 5 Tab, 20 Ref.

Descriptors: *Humic acids, *Fulvic acids, *Activated carbon, *Adsorption, Chlorination, Water treatment, Organic compounds, Water purification, Laboratory tests, Physical properties, Separation techniques, Hydrogen ion concentration, Phosphates, Molecular structure, Organic acids, Soil physical properties.

The formation of trihalomethanes (THM) during chlorination in water treatment processes has been linked to humic acid in the water supply. Removal of THM may be accomplished after the chlorination step, or these compounds may be reduced by removal of THM precursors prior to the addition

of chlorine. The removal of humic substances by activated carbon was examined using commercially supplied humic acid, extracts of a Michigan Finch soil, and extracts of leaves from a local hardwood forest. The materials were characterized by molecular size fractionation, analysis of functional groups, and haloform formation potential. Haloform formation potential was found to be dependent upon material source. No correlations were found between the amounts of oxygen-containing functional groups and the potentials for haloform formation. Seven-day adsorption tests on a bituminous-base activated carbon revealed a source-dependent relationship for removal of humic substances. Adsorption of humic materials from different sources was inversely related to the number of carboxyl groups per unit weight of the substrate. Humic or fulvic acid species of lower molecular weights were more readily adsorbed, presumably due to greater surface areas. Soil fulvic acid adsorption increased with decreases in pH of the solution and increases in phosphate buffer levels. It was recommended that treatment performance for removal of humic substances from water be evaluated prior to treatment, especially when humic materials from different sources are present. (Geiger-FRC)
W81-00630

THE EFFECT OF SAN FRANCISCO'S WASTEWATER PLAN ON WATER QUALITY AND AQUATIC BIOLOGY,
California Univ., Los Angeles.
C. T. Hunsaker.
PhD dissertation, 1980. 192 p, 17 Fig, 20 Tab, 55 Ref, 3 Append.

Descriptors: *Waste water disposal, *California, *Sewage, *Water law, *Sewage bacteria, Aquatic populations, Bays, Coliforms, Pathogenic bacteria, Overflow, Assesments, Swimming, Fishing, Shellfish, Environmental Impact Reports, Waste water management, *San Francisco.

The City and County of San Francisco adopted a Wastewater Management Plan in 1980 that uses an ocean discharge system of eight average annual overflows, The conclusion is drawn that while any of the suggested alternatives would have improved ocean and bay water quality, that which called for just one overflow per year would have been the least adverse to recreatinal users (water contact and shellfishing) of the shoreline and near shore organisms. The five alternatives available were variations of two Master Plans allowing for one, four and eight average annual overflows, through either a deep-water outfall alone or to both the ocean and the bay. The environmental review process for the Master Plan is summarized with reference to water quality and aquatic biology, and describes the probable impact of effluent on bay and ocean shoreline study areas. It was difficult to gather scientific aquatic data for the five proposed alternatives because of a lack of scientific information on heavy metals and other potentially toxic substance concentrations in combined sanitary and stormwater overflow discharges. Federal and state water law, municipal treatment works and the environmental assessment process are described. (Garrison-Omniplan)
W81-00647

OPTIMIZING WATER TREATMENT PLANT OPERATIONS FOR SAVINGS OF WATER, ENERGY, AND CHEMICALS,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
A. C. Chao.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137945, Price codes: A04 in paper copy, A01 in michrofiche. Report, October 1980. 48 p, 20 Fig, 2 Tab, 37 Ref. OWRT-A-108-NC(2), 14-34-0001-9035.

Descriptors: Alkalinity, Backwash, *Water treatment, *Ferric chloride, *Coagulation, Coagulants, Turbidity, Suspended solids, Hydrogen ion concentration, *Filters, Water conservation, Technology, *Filter backwash, Chemicals.

This study investigates the fesibility of reducing the dosage requirement of ferric chloride for the removal of colloidal particles from waters containing low alkalinity by manipulating the pH control of the coagulation process. When metallic salts such as ferric chloride are used as coagulants, the solution pH should be maintained at a certain optimum level to allow the formation of hydroxo-polymers or hydroxide precipitates from the added coagulants. Since the chemical reactions result in reducing the solution pH, bases are simultaneously added to maintain a constant pH at the optimum level. This constant pH method has been practiced for laboratory coagulation studies and in water treatment. The results of laboratory studies indicate that a two-step pH control method can achieve the same removal efficiency as the constant pH method but at lower dosage requirements. The study also investigates the feasiblity of reducing the consumption of treated water for filter backwash. The current backwash practice employs a constant backwash rate of 18-25 gpm/ft sup 2 (50% bed expansion) for 5 - 15 minutes to clean a clogged filter. A new method employs an initial low backwash rate which causes only 10-15% bed expansion. At this bed expansion the sand grains are more efficiently scoured and cleaned than at the higher level for an effective rinsing of the filter bed. Laboratory studies indicate that the new backwash method is as effective as the constant rate method. Because of the low initial rates employed, the new method results in a saving of 30% water consumption. (Kiger-NC)
W81-00686

APPARATUS FOR EMERGENCY WATER PURIFICATION,
E. H. Pavia.
U.S. Patent No 4,196,081, 6 p, 6 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 244, April 1, 1980.

Descriptors: *Patents, *Water treatment, *Water purification, Filtration, Water quality control, Filters, Equipment, Potable water, Emergencies, Sequential filtering.

A method and apparatus for the purification of water in emergency situations is provided, comprising a manually operated pump having a discharge port connected to a number of series-connected treatment filters. Each filter is chosen for its ability to perform a desired purification function in a preferred sequence which enhances the performance of the subsequent filter in the series. The filters are designed to accept water from a contaminated source, thereafter removing particulate matter, and inorganic impurities and inorganic impurities, and finally physically filtering out bacteria and other organisms larger than 0.20 microns in size to deliver potable water from the outlet port of the final filter. Preferably, all components are mounted in a suitable portable enclosure for ease of storing and for transporting the unit to a water source in an emergency situation. (Sinha - OEIS)
W81-00722

HOW VANCOUVER KEEPS ON TOP OF SEWER MAINTENANCE,
Superintendent of City Sewers, Vancouver (British Columbia).
T. Baker.
Water and Pollution Control, Vol 18, No 9, p 22, 24, 37, 43, September, 1980.

Descriptors: Domestic wastes.

Methods currently being used in sewer maintenance in Vancouver, British Columbia are reported by the city's Superintendent of Sewers. Closed-circuit television cameras are used in assessing the condition of sewers. Since 1965, a self-contained, truck-mounted flushing unit using high-pressure water has proved an effective and inexpensive unstopping method. A rodding machine has been used regularly since 1966 to clear sewers of tree roots. The herbicide Sanafoam Vaporooter has also been effective in treating root problems. Sewers have been relined using 12-24 inch PVC piping. A new English product, Insituform, has been used to reline pipes: a resin-impregnated felt bag is cut to measure, installed with cold water pressure, after which the water is heated to cure the resin. Spills of flammable liquids should be contained at the street level and removed or neutralized there. When there is an excess storm water problem, a portable smoke generator and blowers are used to check for possible connections between sanitary and storm sewers (if there is no connection, the smoke will blow out of house stacks; if there is a connection, it will blow out of the down spouts). Equipment used in unstops of property-to-municipal sewer hookups is also discussed. Repair of sewer breaks with rubber couplers is recommended. The records and map system used by the municipal department is also described. (Just-FRC)
W81-00727

SEWER GROUTS AND HOW TO USE THEM.
For primary bibliographic entry see Field 8G.
W81-00728

ENDOTOXINS, ALGAE AND LIMULUS AMOEBOCYTE LYSATE TEST IN DRINKING WATER,
Pittsburgh Univ., PA. Graduate School of Public Health.
J. L. Sykora, G. Keleti, R. Roche, D. R. Volk, and G. P. Kay.
Water Research, Vol 14, No 7, p 829-839, July, 1980. 4 Fig, 5 Tab, 20 Ref.

Descriptors: *Potable water, *Chlorophyta, *Bacteria, *Limulus amoebocyte lysate test, Water quality, Algae, Endotoxins, Analytical techniques, Bioassay, Public health, Regression analysis, Water supply, Pennsylvania, Pittsburgh(PA).

Five water systems in Allegheny county (Pittsburgh, PA) were selected to determine the relationship between various organisms in drinking water and the Limulus amoebocyte lysate (LAL) gelation titer. Non-specific reactions of the LAL assay were also analyzed. The greatest total lipopolysaccharide (endotoxins) levels as measured by the LAL assay were found in the reservoirs with high concentrations of algae and Standard Plate Count bacteria. Uncovered finished water basins were found to have the highest concentrations of phytoplankton. The major source of the 'endotoxic' response was a non-specific reaction caused by algae. Chlorella vulgaris (Chlorophyta) was the most common alga. The LAL test on samples grown in the laboratory verified the phenomenon observed on field samples and indicated a non-specific reaction. Cultures of Schizothrix calcicola, the most dominant Cyanobacterium found in the five water systems, grown under identical conditions produced a specific response. Alkali and lysozyme treatments were capable of distinguishing specific and non-specific LAL reactions. These two techniques and the LAL gelation test are recommended for the assessment of drinking water quality. (McKeon-FRC)
W81-00740

5G. Water Quality Control

MANAGEMENT OF THE HYDROLOGIC SYSTEM IN AREAS SUBJECT TO COAL MINING ACTIVITIES,
Utah Water Research Lab., Logan.
R. H. Hotchkiss, E. K. Israelsen, and J. P. Riley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127383, Price codes: A05 in paper copy, A01 in microfiche. UWRL Water Resources Planning Series P-80/05, October 1980. 84 p, 32 Fig, 16 Tab, 3 Append. OWRT A-046-UTAH(1), 14-34-0001-9047.

Descriptors: *Coal mines, *Multiple-purpose projects, *Water management(Applied), *Land management, Groundwater, Water supply, Water storage, Pumping, Water quality control, Inflow, Colorado River.

The report examines the effects of present mining activities on the associated hydrologic system, and identifies specific mining procedures and management techniques which not only minimize negative hydrologic impacts of mining operations, but which also enhance the value of the hydrologic

system in terms of existing and potential social uses. Thus, the results of the research contribute to the solution of present and future hydrologic problems (both quantity and quality) associated with coal mining in the western U.S. Emphasis is placed on sites which are representative of both existing and future coal mining areas. Specific objectives which are addressed and discussed in terms of actual coal mines in central Utah are (1) evaluation of the potential for using underground coal mines to tap previously inaccessible groundwater supplies, reduce the salt load to the Colorado River by decreasing the contact of groundwater with salt-bearing geologic formations, and store water in abandoned mines; (2) consider the potential effects of underground coal mines on water resources; and (3) evaluate the potential of using surface mined areas to collect surface runoff. The study suggests not only ways of reducing negative hydrologic impacts of mining operations, but also operational and management mining techniques which will enhance the social use value of the hydrologic systems, and thus, in fact, create hydrologic opportunities.
W81-00502

PHOSPHORUS MANAGEMENT FOR THE GREAT LAKES.
International Joint Commission-United States and Canada.
Final Report to International Joint Commission's Great Lakes Water Quality Board and Great Lakes Science Advisory Board, July, 1980. 129 p, 6 Fig, 9 Tab, 97 Ref, 2 Append.

Descriptors: *Phosphorus, *Great Lakes, *Planning, *Water quality, *Control systems, Evaluation, Economic impact, Alternate planning, Phosphorus compounds, Phosphates, Bodies of water, Lakes, Limnology, Aquatic environment, Water quality control, Assessment, Economics, Mathematical models, Model studies, Models, Social impact, Canada.

This report has presented the findings of the Phosphorus Management Strategies Task Force, appointed in the Spring of 1978 by the Great Lakes Science (Research) Advisory Board to investigate alternative strategies for the management of phosphorus inputs to the Great Lakes. Subsequently, the Task Force was expanded to also include interaction to the Water Quality Board of the International Joint Commission. The overall report has considered: the development of the 1978 Great Lakes Water Quality Agreement phosphorus target loads; evaluation of phosphorus inputs in the Great Lakes; review and evaluation of mathematical models for predicting limnological effects of changes in phosphorus loadings and the validity of target loads; costs and technologies of phosphorus control; social/economic impact assessment strategies; and phosphorus management strategy. The next major decision point in the Great Lakes phosphorus management program is anticipated in about five years. Twelve Task Force recommendations were determined for the immediate phase of a phosphorus management strategy. (Zielinski-IPA)
W81-00511

OIL-COLLECTING SHIP FOR OIL SPILLS,
Mitsui Shipbuilding and Engineering Co. Ltd., Tokyo (Japan).
H. Muneta.
U.S. Patent No 4,191,650, 5 p, 4 Fig, 4 Ref: Official Gazette of the United States Patent Office, Vol 992, No 1, p 248-249, March 4, 1980.

Descriptors: *Patents, *Oil spills, *Oil pollution, Water quality control, Skimming, Ships, Equipment, Collection.

A ship for collecting oil from oil spills floating on the surface of the sea comprises a pair of side hulls forming between them a flow passage through which a stream of oil-laden water will flow when the ship travels through the the floating oil. Between the side hulls, a center hull is provided in which a well is formed having a bottom which opens into the flow passage and through which the oil in the passage may float upwardly to be trapped in the well. A pump is provided to pump the trapped oil from the well. The bottom of the well is below the surface of the sea and the stream is deflected under the bottom by a forwardly-inclined segment extending between the side hulls. A splash plate is provided to overlie the upper end of the segment to direct the upward splashes from the segment over the top edge of the segment into a splash chamber behind the segment. The water and/or oil collected in the splash chamber may flow into the well through a connecting opening. (Sinha - OEIS)
W81-00521

APPARATUS FOR FILTER BACKWASHING,
Envirotech Corp., Menlo Park, CA. (Assignee).
E. A. Whitmore.
U.S. Patent No 4,191,652, 7 p, 4 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 249, March 4, 1980.

Descriptors: *Patents, *Water treatment, *Water quality control, Filtration, Filters, Industrial water, Suspended solids, Equipment, Backwashing.

Water often contains particulate material which must be removed before it can be used. Many industrial processes require water which has only minimal quantities of particulate mater. One conventional method for removing particulate material from water is to pass the water downwardly through a bed of filter media comprising sand or some other granular material. As the process is carried out particulate material accumulates in the bed thus resulting in a loss of hydraulic head across the bed. After a substantial quantity of particles builds up in the bed the head loss becomes so great that it is necessary to stop the filtering process and remove the deposited particles. An object of this invention is to provide a filter with an air backwashing device having three cushions of air. Laterals with nozzles are placed below the filter media to convey backwashing air and water into the filter bed. Below the laterals are located a manifold and a distribution plenum to carry air into the laterals. The manifold and distribution plenum are separated by a common wall having ports. (Sinha - OEIS)
W81-00522

TREATMENT OF AQUEOUS SYSTEMS,
CIBA-GEIGY Corp., Ardsley, NY. (Assignee).
D. R. Clark, A. Marshall, and M. A. Finan.
U.S. Patent No 4,192,744, 7 p, 3 Fig, 3 Tab, 13 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 627, March 11, 1980.

Descriptors: *Patents, *Water treatment, *Water quality control, Demineralization, Scaling, Separation techniques, Alkali metals, Flocculation.

The invention provides a method of treating an aqueous system to selectively flocculate compounds of iron ions. A minor proportion of a compound is added in the presence of calcium ions to inhibit the formation of adherent aklaline scales. The compound may be used singly or in a mixture in an aqueous system to be treated in conjuction with other compounds known to be useful in water treatment. (Sinha - OEIS)
W81-00523

ION EXCHANGE METHOD AND APPARATUS,
Chromalloy American Corp., City of Industry, CA. (Assignee).
P. S. Meyers.
U.S. Patent No 4,193,868, 5 p, 2 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 1003, March 18, 1980.

Descriptors: *Patents, *Water treatment, *Ion exchange, Water quality control, Separation techniques, Equipment, Flow control, Regeneration.

This invention provides an ion exchange apparatus constructed so as to utilize a single set or group of manifolds and channels for both service and regenerant flow but which is also constructed to handle comparatively large quantities of water at a comparatively low pressure during service use and to handle and distribute lesser quantities of regenerant solution at a higher pressure during regeneration of the ion exchange bed. Operation can be improved by using a check valve permitting flow in one direction to all of the channels as the bed is being employed under service conditions to treat water and permitting flow in the opposite direction in less than all of the channels as the bed is being treated with regenerant solution. (Sinha - OEIS)
W81-00524

EFFECTS OF BANK STABILIZATION ON THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF STREAMS AND SMALL RIVERS: AN ANNOTATED BIBLIOGRAPHY,
Missouri Univ., Kansas City. Dept. of Biology.
For primary bibliographic entry see Field 4D.
W81-00557

EFFECTS OF BANK STABILIZATION ON THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF STREAMS AND SMALL RIVERS: A SYNTHESIS,
Missouri Univ., Kansas City. Dept. of Biology.
For primary bibliographic entry see Field 4D.
W81-00559

IN-GROUND PRECIPITATION ENDS WELL-SCREEN PLUGGING,
K. Grover.
American City and County, Vol 95, No 4, p 55-58, April, 1980. 2 Fig.

Descriptors: *Wells, *Iron, *Manganese, *Chemical precipitation, Aquifers, Corrosion, Well casings, Aeration, Filtration, Sands, Costs, Metals, Municipal water, Injection, Hydrogen ion concentration, Oxidation-reduction potential, Gravels, Groundwater.

The first U.S. in-situ system to remove iron and manganese from well water supplies is being installed at Pembroke, Massachusetts. The town well at Pembroke plugged repeatedly in spite of costly cleaning steps and various efforts to sequester the iron. This new method includes an aeration procedure followed by sand filtration, as do other treatment methods. However, the new process, Vyredox, which was developed in Finland, uses the sand and gravel in the well itself as a filter. Conventional systems require chemical addition to cause precipitation, while Vyredox employs natural biochemical precipitation. Redox potential and pH are kept so high that iron and manganese are precipitated and retained in the sand-gravel layers of the aquifer. In a typical installation, a number of aeration wells are placed around a supply well. Water from an outside source is passed through an oxygenator for degassing and oxygen enrichment. This water is then injected into the aquifer. Since underground filtration is slower, it is assumed to be more efficient than above-ground filtration in removing iron and manganese. The process is suited to shallow sand-gravel aquifers. One disadvantage is the cost of determining whether the process will be successful at a given location. Pilot tests can cost about $40,000, $15,000 of which is for finished injection wells that will be used in the final installation. (Baker-FRC)
W81-00588

CROSS-CONNECTION CONTROL MEANS POTABLE WATER SAFETY.
American City and County, Vol 95, No 1, p 61-62, January, 1980. 1 Tab.

Descriptors: *Potable water, *Diseases, *Municipal water, *Water distribution(Applied), Water quality, Water pollution sources, Water pollution effects, Public health, Water pollution control, Sewerage, Distribution systems, Human diseases, Local governments, Legislation, Odor.

Various wasy to achieve cross-connection control for potable water supplies are considered. Cross-connections can occur whenever a potable system is connected to a non-potable supply operating at a higher pressure. The negative pressure or reduced pressure in the line causes backsiphonage. It is estimated that 90% of consumer complaints about

bad odors in the water in Cleveland can be traced to cross-connection problems. Of 3,926 cases of water borne disease caused by contamination through the distribution system and reported to the National Center for Disease Control between 1946 and 1970, 1,752 were attributed to cross-connections, and 785 were caused by backsiphonage. One method of achieving control requires the customer to install an approved backflow prevention device at each service connection. Other criteria necessary to establish a cross-connection control program include the designation of a single authority in charge of the program, understanding of state law and development of local ordinances, familiarity with various approved control devices, knowledge of installation procedures, periodic maintenance and testing, thorough record keeping, and organization of an effective public information program. Schemes which have been devised for this problem in Henrico County, Virginia and in Cleveland are briefly reviewed. (Baker-FRC)
W81-00589

METHODS FOR THE ISOLATION OF VIRUS FROM RAW AND DIGESTED WASTEWATER SLUDGE,
Royal Veterinary and Agricultural Univ., Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
A. L. Nielsen, and B. Lydholm.
Water Research, Vol 14, No 2, p 175-178, February, 1980. 3 Tab, 14 Ref.

Descriptors: *Viruses, *Sewage sludge, *Sludge disposal, *Pollutant identification, *Tertiary treatment, Fertilizers, Soil contamination, Toxins, Environmental sanitation, Laboratory tests, Analytical techniques, Isolation, Separation techniques, Waste disposal, Waste water treatment, Adsorption, Temperature, Hydrogen ion concentration, Disinfection.

Increased interests in the use of sludge as fertilizer for land application has raised problems of the treatment of sludge for removal of viruses. Virus removal from sludge has been complicated by the lack of detection methods for viruses in sludge. Studies measuring the viral content of sludges that have been directly inoculated fail to account for the differences that may exist between indigenous viruses incorporated into sludge and artificially intruduced viruses that are absorbed onto the surfaces of particles. In the present study, four different quantitative techniques for the detection of viruses in waste-water sludges were tested on raw and digested sludge. Satisfactory results were obtained with acidic precipitation followed by elution with beef extract and alum precipitation followed by elution with tris buffer. Good recovery was also obtained with elution with beef extract even on sludge with high levels of total suspended solids. Direct inoculation of sludge into cell cultures was unfeasible due to the harmful effects of other sludge constitutents to cells. Viruses were found in all raw sludge samples and at a higher concentration than in digested sludge specimens. Some of the viral types identified were coxsackievirus B2 and B5, poliovirus 1, 2, and 3, and adenovirus 1 and 2. In one sample, adenovirus type 2 was detected one day after sludge application to land and in another sample, coxsackievirus B5 was identified 4 months after sludge application to land. (Geiger-FRC)
W81-00632

REDUCTIONS IN INACTIVATION RATES OF BACERIOPHAGES BY CLAY MINERALS IN LAKE WATER,
New York Univ., NY. Lab. of Microbial Ecology.
H. Babich, and G. Stotzky.
Water Research, Vol 14, No 2, p 185-187, February, 1980. 3 Fig, 24 Ref.

Descriptors: *Viruses, *Adsorption, *Clay minerals, *Lakes, *Pathogenic bacteria, Suspended solids, Suspension, Filtration, Disinfection, Bacteriophage, Path of pollutants, Water pollution sources, Enteric bacteria, Heat treatment, Humic acids, E. coli, Water quality control.

The effect of clay minerals on the survival of bacteriophages of Eschrichia coli and Staphylococcus aureus were studied in natural water samples from the freshwater Lake Kauneonga. Clay preparations of kaolinite, montmorillonite, vermicullite, or attapulgite clays were added at different concentrations to test tubes of lake water inoculated with two phages of E. coli and three of S. aureus. The test tubes were serially diluted with buffer and applied to appropriate host bacterial cultures on agal plates. Plaques were counted after 18 hr of incubation. Results showed variations in the stabilities of bacteriophages in natural lake water. The rate of inactivation of an S. aureus phage was found to be greatly reduced in the presence of clay minerals in either filtered or autoclaved or unautoclaved lake water with the sequence of protection being attapulgite>vermiculite>montmorillonite, kaolinite. The viral protection afforded by the clays was attributed to the adsorption of the viruses onto the clay particles in the lake water suspensions. Lake of protection of viruses by the addition of humic acids or heat-killed microbial cells in other experiments could have been due to the inability of these materials to successfully adsorb the viruses. (Geiger-FRC)
W81-00636

DEVELOPMENT OF CHLORINE RESISTANT MEMBRANE, ASYMMETRIC POLYIMIDE MEMBRANE AND POROUS SUBSTRATES,
Membrane Systems, Inc., San Diego, CA.
R. G. Sudak, J. M. Chirrick, R. L. Fox, M. E. McKee, and J. B. Bott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142242, Price codes: A11 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, September, 1980. 234 p, 62 Fig, 92 Tab. OWRT-C-90176-D(No 9515)(1), 14-34-0001-9515.

Descriptors: *Membranes, *Research and Development, *Filtration, *Reverse osmosis, *Polymers, Permeability, Permselective membranes, Porous media, Films, Waste water treatment, Water pollution treatment, Water quality, Water qualtiy control, Pores, Plastics, Chlorination, Stability, Heat resistance, Membrane processes, Separation techniques, Semipermeable membranes, Synthesis, Water treatment.

This study was divided into three concurrent projects for development of (1) porous substrates for composite membranes, (2) chlorine-resistant membranes, and (3) asymetric polyimide membranes. Under (1) development of supports with different polymeric materials (other than polysulfone) was undertaken to increase: (a) the number of possible solvents for use in membrane barrier layer formation; and (b) the allowable temperatures for such formation. These new materials were developed with pore size variations for use in ultrafiltration/microfiltration applications as well as hyperfiltration. For polyimide porous supports, asymmetric membrances could be cast with a degree of permselectivity, undertaken to improve polyimide membrane reverse osmosis characteristics. Cellulose acetate is stable to low residual chlorine concentrations in feedwaters, but polyimide in sheet composite membrane or asymetric hollow fine fibers were not. Instability was attributed to secondary amines in the membrane barrier layer polymer. The mechanism of residual chlorine degradation of various polymers was investigated, which led to synthesis of several polymers and their subsequent reaction to form polyimide membrane layers. (Zielinski-IPA)
W81-00681

STATUS REPORT ON ABATEMENT OF WATER POLLUTION FROM THE CANADIAN PULP AND PAPER INDUSTRY (1978).
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
Report No EPS 3-WP-80-4E, May 1980. 23 p, 2 Fig, 10 Tab, 2 Append.

Descriptors: *Water pollution sources, *Pollution abatement, *Pulp wastes, Industrial wastes, *Canada, *Pulp and paper industry, Pulp wastes, Wastes, Water pollution, Sulfite liquors, Wood wastes, Paper industry, Lumbering, Abatement, Control, Water pollution control, Biochemical oxygen demand, Suspended solids, Fish toxins, Mills, Pollutants.

Canadian pulp and paper effluent regulations limiting the discharge of suspended solids, biochemical oxygen-demanding substances, and toxic materials were promulgated under Federal Fisheries Act in November, 1971. This report, presented in English and French, gave an assessment of progress made to 1978 in meeting discharge objectives, and projected future developments through to 1986. This assessment was a result of a review of individual mill operations and written complianace programs, and was developed through Environmental Protection Service regional personnel and provincial environmental agencies cooperation. Effluent discharges from the pulp and paper industry are presented in terms of total suspended solids (TSS), biochemical oxygen demand (B0D-5), and wastes toxic to fish. While pulp and paper production increased about 5% between 1976 and 1978, TSS discharges were reduced by about 14% and BOD-5 decreased by about 5%. TSS discharges decreased for all regions except the Pacific region, which remained stable; B0D-5 discharges were lower in all regions except Quebec, which remained the same as 1976. Mills in compliance for TSS and B0D-5 increased over the 1975/76 to 1978 period by 13 and 8, respectively. Fifty-four mills test toxicity of effluents to fish, but a large number of mills do not. (Zielinski-IPA)
W81-00703

METHOD AND DEVICE FOR REMOVING SOLID AND/OR LIQUID MEANS CONTAINING HARMFUL SUBSTANCES,
E. Crema.
U.S. Patent No 4,194,978, 11 p, 7 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 992, No 4, p 1382, March 25, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Water quality control, Water reuse, Equipment, *Waste spills, Suction, Water jet pumps.

A method and apparatus for removing solid and/or liquid matter containing harmful substances from the ground or from the surface of water is described. A vacuum up to 0.1 bar is generated by a water jet pump, whereby the matter can be sucked up even over differences in height of almost 10 meters. The water jet pump is arranged in a closed water circulation system which uses a centrifugal pump for its drive, preferably a fire-extinguishing pump. In order to prevent the harmful substances from getting into the water circulation, a collecting vessel is arranged in the suction line for the harmful substances. (Sinha - OEIS)
W81-00713

PLEATED FILTER UNDERDRAIN, METHOD AND APPARATUS,
Harsco Corp., Wormleysburg, Pa. (Assignee).
T. D. Ward.
U.S. Patent No 4,196,079, 8 p, 8 Fig, 9 ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 243, April 1, 1980.

Descriptors: *Patents, *Water pollution treatment, *Filtration, Water purification, Filters, Waste water treatment, Equipment, Air circulation, Backwashing.

Filter beds for use in moving suspended solids from water supplies to meet present day requirments for potable water and waste effluent quality generally use a layer filter bed generally comprised of a graded sand and gravel media having gravel at the lowermost position, and the sand, anthracite coal and other fine media layered on top. A method and apparatus is described for air scouring a layered filter bed when air is dispersed into the finer particles of the bed without disturbing the coarse large aggregate in the lower portion of the bed to prevent inter-mixing of the fine aggregate with the large aggregate. The filter underdrain comprises a corrugated support structure forming peaks and valleys. The larger granular filter media

is placed in the lower portion of the valleys. The peaks of the filter support form air channels through which pressurized air is dispensed during the cleaning cycle to air scour the sand. Drainage apertures are formed in the lower portion in the gravel through which the filtered water flows into the lower portion of the channels and into storage facilities. (Sinha - OEIS)
W81-00721

APPARATUS FOR EMERGENCY WATER PURIFICATION,
For primary bibliographic entry see Field 5F.
W81-00722

FLOATING, SURFACE LIQUIDS RETRIEVAL SYSTEM,
E. T. Gordon.
U.S. Patent No 4,196,087, 12 p, 13 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 246, April 1, 1980.

Descriptors: *Patents, *Oil spills, *Oil pollution, Water pollution treatment, Water quality control, Equipment, Floating, Separation techniques, Vacuum suction, Floating boom.

A floating retriever for retrieving spilled oil or other liquid substances on the top of water has a central liquid collection chamber with a vacuum or suction pick-up for delivery of the pollutants to a mother vessel. The Vessel controls the retriever by means of a boom structure. The retriever has a large surrounding circular float with intake ports with 'V' shaped lateral screws to bring the retrieved liquid to the collection chamber. The device includes an inverted-dome water well with limited openings underneath the collection chamber for stability, as well as radially positioned, selectively controlled, out-rigged screws including an auxiliary tow, for drawing the oil to the intake ports and providing for propulsion and guidance. The ports have inclined stepped bottom surfaces with discharge holes with a lower paddle wheel drive to initially enhance oil/water separation, as well as jets or sprays for producing a suction effect in the intakes. (Sinha - OEIS)
W81-00724

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

MULTIOBJECTIVE ANALYSIS IN THE MAUMEE RIVER BASIN: A CASE STUDY,
Case Western Reserve Univ., Cleveland, OH. Systems Engineering Div.
Y. Y. Haimes, P. Das, and K. Sung.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127524, Price codes: A11 in paper copy, A01 in microfiche. Completion Report submitted to the National Science Foundation and the Office of Water Research and Technology, October, 1979. 226 p, 12 Fig, 18 Tab, 71 Ref, 2 Append. OWRT-C-7047(No 6221)(6), 14-34-0001-6221.

Descriptors: *River basins, *Planning, *Mathematical models, *River basin development, Mathematical studies, Model studies, *Decision making, Data collections, Probability, Basins, Watershed management, Watersheds(Basins), Rivers, Bodies of water, Water resources planning, Comprehensive planning, Estimating equations, Statistical models, Input-output analysis, Optimization, Ohio, *Maumee River basin.

Systematic evaluation and identification of critical existing/future water/land resources problems in the Maumee River Basin was undertaken to consider formulation of a planning/management framework as a sound decision-making tool for the Basin. Planning was carried out with Maumee River Basin Level-B Planning Board cooperation, and the study results were used in Level-B planning and in formulating a recommended plan for the Basin. The study was divided into two phases. Phase I covered mathematical models development; integrating and testing the models with the available data base to determine their use as planning tools; and implementation of the Surrogate Worth Trade-off (SWT) method. Phase II covered analysis of Phase I results, improving the developed mathematical models, and evaluating the success of the SWT method; incorporating multiobjective water/land resources analysis into broader environmental/economic objectives; extending the hierarchical multiobjective structure and solution techniques; and documenting the overall experiences. Using SWT, decision-maker preferences and used only in the final analysis stages where surrogate worth functions are evaluated at specific points in the function space to determine the preferred solution. (Zielinski-IPA)
W81-00507

BASIN DEVELOPMENT AND WATER ALLOCATION,
Nevada Univ. System, Reno. Desert Research Inst.
J. W. Fordham, G. F. Cochran, H. N. Friesen, W. W. Pidcoe, and S. A. Bamberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127276, Price codes: A04 in paper copy, A01 in microfiche. Publication No 41065, 1980. 53 p, 19 Fig, 9 Tab, 14 Ref, Append. OWRT-B-038-NEV(4) and B-050-NEV(2), 14-31-0001-3104, 14-31-0001-3612.

Descriptors: *Model studies, *Water resources development, *Nevada, *Semiarid climates, *Water rights, Mathematical models, Water law, Simulation analysis, Precipitation(Atmospheric), Snowmelt, Groundwater movement, Subsurface flow, Surface-groundwater relationships, Watersheds(Basins), *Great Basin.

Simulation techniques are described which would aid in the allocation of ground and surface water in semi-arid basins. The study area was Hualapai Valley in the northwestern Great Basin about 115 miles north of Reno, Nevada. The study was undertaken to simulate the combined surface and subsurface hydrology of a desert basin undergoing development and to determine the effects of the application of water right law on the hydrologic system. The utilization of the simulation models developed in conjunction with computerized water right information can provide the basis for approval or rejection of applications to appropriate water and criteria for allocation of water to users during periods of deficient supply.
W81-00514

LEAST COST DESIGN OF URBAN DRAINAGE SYSTEMS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 4C.
W81-00552

INVOLVING THE PUBLIC IN WATER AND POWER RESOURCES DECISIONS,
Creighton and Creighton, Saratoga, CA.
J. L. Creighton.
Available from Supt. of Documents, GPO, Washington, DC 20402. Water and Power Resources Service Report, June 1980. 340 p, 21 Fig, 39 Ref, 2 Append. 8-07-83-V0709.

Descriptors: *Planning, *Water resources, Evaluation, Social aspects, Social participation, Decision making, Methodology, Public involvement.

This manual presents standards, instructions, and techniques for planning, implementing, and reporting public involvement programs. It is applicable to public involvement in the planning of large and small scale projects and progams that will significantly affect the public, and is specifically applicable to public involvement in water resources planning. The manual presents: the rationale and general principles for public involvement; guidelines and techniques for determining the need for public involvement, identifying the affected groups, and designing a public involvement program; organizational issues involved in administering and coordinating public involvement programs; techniques for designing and running public meetings, and methods other than public meetings for involving the public in the planning process. An appendix provides examples of printed materials for communication with the public, such as newsletters, public announcements, brochures and booklets. (Moore - SRC)
W81-00558

TEXAS LIGNITE: ENVIRONMENTAL PLANNING OPPORTUNITIES,
Fish and Wildlife Service, Fort Worth, TX.
T. J. Cloud, Jr.
Available from Supt. of Documents, GPO, Washington, DC 20402. Report FWS/OBS-78/26, June 1978. 19 p, 1 Fig, 1 Tab, 32 Ref.

Descriptors: *Strip mines, *Lignite, *Environmental effects, *Plannning, Texas, Land reclamation, Social aspects, Recreation, Wildlife, Vegetation, Coal mines, Public involvement.

To date, the adverse effects of lignite surface mining in Texas have been limited due to the small number of mining operations in existence. However, to meet future energy demands large areas of east and southcentral Texas will be strip mined for lignite. Aquatic, terrestrial, and recreational environmental impacts which will potentially be assoicated with lignite strip mining are discussed. Opportunities for proper environmental protection measures are proposed, including involving concerned agencies and the public in planning, the establishment of reclamation plans, and the development of information regarding the environmental requirements of plant and animal species. (Moore - SRC)
W81-00562

PROMISING METHODOLOGIES FOR FISH AND WILDLIFE PLANNING AND IMPACT ASSESSMENTS,
Fish and Wildlife Service, Denver, CO.
For primary bibliographic entry see Field 6G.
W81-00565

PLANNING REPORT FOR THE IRRIGATION PORTION OF A DUAL WATER SYSTEM FOR WEST JORDAN CITY, SALT LAKE COUNTY, UTAH,
Utah Div. of Water Resources, Salt Lake City.
For primary bibliographic entry see Field 3C.
W81-00649

ENVIRONMENTAL ASSESSMENTS IN WATER RESOURCES PLANNING,
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W81-00704

6B. Evaluation Process

WATER REQUIREMENTS AND COSTS FOR SOUTH DAKOTA RURAL MANUFACTURING FIRMS,
South Dakota State Univ., Brookings. Dept. of Economics.
R. Hoffman, and T. L. Dobbs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131088, Price codes: A06 in paper copy, A01 in microfiche. Research Project Technical Completion Report, 1980. 108 p, 32 Tab, 19 Ref, 3 Append. OWRT A-071-SDAK(1), 14-34-0001-9044.

Descriptors: *Water requirements, *Water supply, *South Dakota, *Rural areas, *Industrial plants, *Cost analysis, Costs, Econometrics, Community development, Factories, Water use, Water distribution(Applied), Feasibility, Cost-benefit analysis, Instrumentation, Evaluation, Statistical methods, Statistics, Data collections, Economic feasiblity, Economic impact.

A mail survey of manufacturing firms, a personal survey of a subsample of manufacturing firms, and a personal survey of certain municipal offices pro-

vided the data for this study. Cross-tabulation was used to evaluate relationships among variables, covering firm type, water volume use, town size, water supply source, employment, special water supply considerations in firm location, water problems, and water-related facilities used by firms. Analysis of variance and regression tested for differences in water volume use among firm types, firm employment levels, and firms in varying town sizes. A budgeting procedure was used to estimate possible costs due to municipal water system expansion to accommodate a new firm. Firms of Instruments and Food manufacturing classifications averaged the highest water level use in 1978; while Lumber Products and Transportation firm classifications were among the lowest 1978 water consumers. Annual water use increased with firm employment size. Firms having production, heating, or cooling as their major water use used more water annually than firms using water principally for drinking and sanitation. Estimates of water use by industry type can be used by planners for water system expansion needs to accomodate new industry. (Zielinski-IPA)
W81-00550

INVOLVING THE PUBLIC IN WATER AND POWER RESOURCES DECISIONS,
Creighton and Creighton, Saratoga, CA.
For primary bibliographic entry see Field 6A.
W81-00558

TEXAS LIGNITE: ENVIRONMENTAL PLANNING OPPORTUNITIES,
Fish and Wildlife Service, Fort Worth, TX.
For primary bibliographic entry see Field 6A.
W81-00562

STRATEGY FOR ASSESSING IMPACTS OF POWER PLANTS ON FISH AND SHELLFISH POPULATIONS,
National Power Plant Team, Ann Arbor, MI.
E. S. Fritz, P. J. Rago, and I. P. Murarka.
Available from Supt. of Documents, GPO, Washington, DC 20402. Report FWS/OBS-80/34, July 1980. 80 p, 18 Fig, 87 Ref.

Descriptors: *Powerplants, *Environmental effects, *Shellfish, *Fish, Planning, Statistical models, Environmental impact.

The shortcomings of existing guidance documents and environmental impact assessments for power plants indicate the need for a strategy or plan which can enhance the efficiency of data collection and the reliability of conclusions. A strategy was designed for use by biologists responsible for conducting or reviewing assessments of impacts on fish and shellfish. The strategy consists of six steps: conceptualization of the ecosystem to be assessed; design and execution of needed pilot investigations; refinement of conceptualization; design of a study plan; execution of the study plan; and evaulation of impact. An interdisciplinary group consisting of a fisheries biologist, a physiologist and behaviorist, a biostatistician, a population dynamicist, a systems ecologist, and a design engineer is assembled to conduct the assessment. The strategy is the procedure for assessing the effects of a generalized electric generating facility site in an area where the impact on fish and shellfish is high. However, it can be applied to assessments for less sensitively sited facilities, site evaluation studies, assessments for existing facilities, and additions to existing facilities. (Moore - SRC)
W81-00563

OPERATIONAL STUDY FOR PLANNING PURPOSES OF A PUMP-STORAGE RESERVIOR SYSTEM,
California Univ., Los Angeles.
A. Tabatabaee-Diba.
MS thesis, 1980. 59 p, 19 Fig, 4 Tab, 22 Ref, 1 Append. Water Resources Center Archives, University of California, Los Angeles. UCAL-WRC-W-535.

Descriptors: *Pumped storage, *Reservoirs, *Hydroelectric plants, *Simulation analysis, *Planning, Reservoir yield, California, Demand, Pricing, Power marketing, Load distribution, Peak loads, Peak power, Hydrology.

Pump-storage technique is a promising method for production of hydroelectric energy and has become a significant element of the electric power systems of the 1980's. For planning purposes, a parametric search technique was used to study the revenue response of a pump-storage reservoir system to changes in demand and other operational constraints. The results show that the parametric study can be used effectively for project planning and operation of such a system. The Oroville-Thermalito reservoir system in northern California was selected for analysis, using sixty years (1914-1973) of monthly historical stream flows routed through the system in wet and dry weather cycles. Average yearly revenue from the sale of power was considered as the dependent variable. The independent variables were: (1) the requested or contractual power level; (2) the ratio of the total number of minimum on-peak hours to the total number of hours; and (3) the ratio of the value of the off-peak to the on-peak energy output. That the energy demand was treated parametrically suggests that the study is suitable for future planning purposes of the system. (Garrison-Omniplan)
W81-00646

EXPLORATIONS IN MULTIOBJECTIVE WATER RESOURCE HISTORY,
Massachusetts Inst. of Tech., Cambridge, MA. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
D. C. Major, R. Ambrose, and R. Coleman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-133415, Price codes: A05 in paper copy, A01 in microfiche. Technical Report, June, 1977. 87 p, 3 Tab, 76 Ref OWRT-C-5172(No 4206)(1).

Descriptors: *Planning, *Water resources development, *Multiple-purpose projects, *Comprehensive planning, *Research priorities, Project planning, Water resources, Management, Water policy, Civil engineering, River basin development, Reclamation, Federal Government, Legal aspects, Political aspects, Economics, History.

In this exploratory study, several key programs were examined, using specified data sources to study each, to gain a perspective of the role of multiobjectives in the history of water resources planning in this country. Programs selected for study were the reclamation program and the 308 program, as well as a river basin planning effort that developed as a result of the 308 program. It was concluded from the sources studied that both the reclamation program and the 308 programs were multiobjective, but in different ways. The former, studied primarily through analysis of debates in Congress, was multiobjective with respect to regional and social aims (especially when related to the family homestead); while the latter contained multiobjective elements related to lives and safety with respect to monetary measures of national income benefits and costs. Congressional committee and floor debates on 308 projects might reveal a broader multiobjective character than the Corps reports. Three exceptional areas for follow-on studies were suggested by the exploratory study reported here. (Zielinski-IPA)
W81-00674

WATER AS A PARAMETER FOR DEVELOPMENT OF ENERGY RESOURCES IN THE UPPER GREAT PLAINS -- EFFECTS ON LAND AND WATER RESOURCES OF ALTERNATIVE PATTERNS OF COAL-BASED ENERGY DEVELOPMENT,
North Dakota Agricultural Experiment Station, Fargo.
D. F. Scott, G. H. Pfeiffer, and D. E. Gronhovd.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-133670, Price codes: A03 in paper copy, A01 in microfiche. Research Report No 70, December, 1978. 35 p, 7 Fig, 22 Tab, 27 Ref. OWRT-C-7187(No 6217)(1), 14-34-0001-6217.

Descriptors: *Great Plains, *Coal mines, *Cost analysis, *Land reclamation, *Surface water availability, Costs, Income, Geographical regions, North Dakota, Coals, Fuels, Fossil fuels, Montana, Wyoming, Industrial production, Planning, Coal mine wastes, Economics, State Governments, Water supply, Water utilization, Water users, Water demand, Water distribution(Applied), Cost-benefit analysis.

This report represents volume II of a two-volume study report on the analysis of the effects of alternative patterns of coal-based energy development in the Upper Great Plains on resource use, economic activity, and polulation distribution in the region. The volume addressed the effects of coal-based energy production on the region's land and water resources; Volume I addressed the effects on economic activity, population growth and settlement patterns, and the costs and revenues to State and local levels of government of coal development in the region. Volume II presented a detailed analysis of mined land reclamation costs in North Dakota (along with costs for selected mine sites in Montana and Wyoming); identified existing surface water supplies and use in the region; and discussed the impacts of alternative levels of coal development on water resources. Upper Great Plains energy development will have an impact on the region's water resources. It was concluded however, that available area water resources appear sufficient to satisfy needs of increased reliance on coal resources without undue hardship on sectors of the region's economy. Aggregate average water seemed available in sufficient quantity, but detailed planning will be needed for effective development. (Zielinski-IPA)
W81-00691

WATER AS A PARAMETER FOR DEVELOPMENT OF ENERGY RESOURCES IN THE UPPER GREAT PLAINS -- SOCIOECONOMIC EFFECTS OF ALTERNATIVE PATTERNS OF COAL-BASED ENERGY DEVELOPMENT,
North Dakota Agricultural Experiment Station, Fargo.
N. E. Toma, N. L. Dalsted, J. S. Wieland, and F. L. Leistritz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-133662, Price codes: A08 in paper copy, A01 in microfiche. Research Report No 71, December, 1978. 144 p, 59 Fig, 137 Tab, 24 Ref, 1 Append. OWRT-C-7187(No 6217)(2), 14-34-0001-6217.

Descriptors: *Great Plains, *Coal mines, *Cost analysis, *Welfare(Economics), *Computer models, *Social impact, Costs, Income, Geographical regions, North Dakota, Coals, Fuels, Fossil fuels, Montana, Wyoming, Industrial production, Planning, Coal mine wastes, Economics, State Governments, Water supply, Water utiliztion, Water demand, Mathematical models, Cost-benefit analysis.

This report represents Volume I of a two-volume study report on the analysis of the effects of alternative patterns of coal-based energy development in the Upper Great plains on resource use, economic activity, and population distribution in the region. The volume addressed the effects on economic activity, population growth and settlement patterns, and the costs and revenues to State and local levels of government of coal development in the region; Volume II addressed the effects of coal-based energy production on the region's land and water resources. Volume I presented a detailed conceptual description of a computerized model proven useful in North Dakota for projection of economic, demographic and fiscal effects on coal development; an in-depth analysis of the effects of three alternative levels of North Dakota coal development (and brief summaries for Montana and Wyoming); and discussions of existing/potential measures for alleviation of adverse fiscal effects resulting from coal development, and of socio-economic charcteristics of the coal industry's Upper Great Plains work force and a local labor supply model. Shortfalls of front-end financing to offset rapid energy development growth effects appeared as the most serious potential fiscal difficulty for all government levels. (Zielinski-IPA)

W81-00692

ASSESSMENT AND RECOMMENDATIONS FOR COMMUNITY WATER RESOURCES PLANNING.
Skidmore, Owings, and Merrill, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137911, Price codes: A07 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October, 1980. 132 p, 16 Fig, 80 Ref, 7 Append. OWRT-C-80104-P(No 8402)(1), 14-34-0001-8402.

Descriptors: *Planning, *Suburban areas, *Water resources development, *Local governments, *Legal aspects, State Governments, Massachusetts, Governmental interrelations, Federal Government, Governments, Administration, Water allocation(Policy), Water demand, Water distribution(Applied), Municipal water, Evaluation, Water conservation, Water utilization, Water management(Applied), Cities.

This study examined local planning in response to water supply shortages and related water quality and land management factors in a case study suburban town (Stoughton) near Boston, Massachusetts. Following initial survey of local water resource issues in the study town, the study team provided planning and technical assistance to aid the development of a local resource management strategy. A six-step planning process was prepared and tested, based on apparent guidance needs in resource planning techniques. It was concluded that local government appears to be the most appropriate body to deal with local resource mangagement issues, but also that it is often ill-equipped to do so. Local governments place heavy reliance on traditional structural solutions, which if inadequate, are replaced by more appealing non-structural options, yet, the latter often require sophisticated preparation/execution for success. These findings concur with regional, State, and Federal policies that emphasize local water resource self-sufficicency and resource preservation. Technical assistance efforts to communities are needed for communities to meaningfully respond to such policies. The study procedures employed have a broad potential application to numerous town and small cities in the United States. (Zielinski-IPA)
W81-00696

ENVIRONMENTAL ASSESSMENTS IN WATER RESOURCES PLANNING,
Stanford Univ., CA. Dept. of Civil Engineering.
L. Ortolano.
Water Supply and Management, Vol 2, No 2, p 159-176, 1978. 1 Fig, 3 Tab, 35 Ref. OWRT-C-4080(No 9017)(4).

Descriptors: *Environmental assessment, *Water resources planning, *Iterative open planning process(IOPP), *Evaluation, Environmental impacts, Regulation, Prediction, Impact identification, Models, Multi-objective planning, Research, Mathematical programming, Planning, Forecasting.

Since 1970 environmental assessments have been required for water resources planning studies undertaken by federal agencies responsible for water resources development in the U.S. These assessments are mandated by the National Environmental Policy Act of 1969 (NEPA) and by the Water Resources Council's 'Principles and Standards for Planning Water and Related Land Resources,' thereby elevating environmental quality to status of a formal planning objective. Environmental assessment methods are divided into three parts corresponding to impact identification, prediction and evaluation. For impact identification the methods are checklists, matrices, network diagrams and state-of-the-art reviews. Single discipline procedures (e.g., air, water quality models) and cross impact procedures (e.g., systems dynamics models) are methods for impact prediction. For impact evaluation there are environmental evaluation procedures (e.g., those using weighted average of factors); and multi-objective evaluation procedures (e.g., mathematical programming). However, studies indicate that the influence of environmental assessments on the outcome of water resources planning studies has not been great and there has been little integration of results into other aspects of the planning process. Environmental assessment activities can be linked with more traditional planning activities by the 'iterative, open planning process' method which relies on continual two-way communication between agency planners and interested citizens and government agencies. It also calls for the performance of four traditional planning activities: problem definition, formulation of alternatives, impact assessment and plan ranking. (Iervolino-NC)
W81-00704

EUTROPHICATION IN PEEL INLET-II. IDENTIFICATION OF CRITICAL UNCERTAINTIES VIA GENERALIZED SENSITIVITY ANALYSIS,
California Univ., Berkeley. Dept. of Biomedical and Environmental Health Sciences.
For primary bibliographic entry see Field 5B.
W81-00726

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

DESIGNING EQUITABLE WATER RATES: WHAT MANAGERS NEED KNOW,
Illinois State Commerce Commission, Springfield.
W. J. Ide.
Journal of the American Water Works Association, Vol 72, No 10, p 564-569, October, 1980. 9 Ref.

Descriptors: *Water rates, *Pricing, *Utilities, Public utilities, Governments, Water users, Management, Costs, Replacement costs, Rehabilitation.

Factors involved in establishing rates for water usage are discussed. These factors include a study of the revenue requirements, an allocation of cost to various classes of users, and designing of the rate schedule. Revenue requirements for most government-owned utilities, however, are usually determined on a cash or budget basis and consist of estimated cash requirements. The emphasis placed on cash needs results from the fact that government-owned utilities are mainly backed by bonds which must be repaid in cash. Items that must be included in the budget are replacements, normal extensions of service, and normal improvements. Major improvements may be included as appropriations. Factors discussed in the design of rate structures include decreasing block rates, modified decreasing block rates, constant unit price rates, flat rates, off-peak, interruptible, and seasonal rates, conservation rates, lifeline rates, and availability charges. It is emphasized that, in the current socio-economic situation, consumers are becoming increasingly aware of rate increases, and that water-utility management must understand the fundamental principles involved in determining the necessary funds and designing equitable water rates. (Baker-FRC)
W81-00593

THE FUTURE OF AGRICULTURAL WATER USE IN NEW MEXICO,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Economics and Agricultural Business.
For primary bibliographic entry see Field 6D.
W81-00643

AGRICULTURAL WATER USE AND COSTS IN CALIFORNIA,
California Univ., Berkeley.
For primary bibliographic entry see Field 3F.
W81-00644

6D. Water Demand

FRESHWATER USE CUSTOMS ON ROTA: AN EXPLORATORY STUDY.
Guam Univ., Agana. Water Resources Research Center.
For primary bibliographic entry see Field 7C.
W81-00640

THE FUTURE OF AGRICULTURAL WATER USE IN NEW MEXICO,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Economics and Agricultural Business.
G. Dawson.
In: A Quarter Century of Water Research, Proceedings of the Twenty-Fifth Annual New Mexico Water Conference, Apr. 24-25, 1980, WRRI Report No 124, Aug. 1980. p 203-217, 17 Ref. New Mexico Water Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *New Mexico, *Agriculture, *Water quality, *Water costs, Food supply, *Economic impact, Farm management, Irrigation, Land use, Projections, Energy developments, Projected planning, Crop production, Regional economics.

The future availability of irrigated land for New Mexico is uncertain. Key elements of New Mexico's water law---doctrines of 'prior appropriation' and 'beneficial use'--- have met the state's agricultural water requirements to date. However, with demand outstripping supply, prices can and will be paid to shift water from agricultrual uses to 'higher valued' uses such as energy production. Depressed crop prices in 1979 and economic forecasts of low prices for 1980 may result in farmers' selling their water instead of their produce. The Federal Intermediate Credit Bank of Wichita reported that loans for farming production purposes were up 32% from 1978. Valley irrigated land values have been increasing at an annual rate surpassing 7%. Predictions for farming in the year 2025 must consider local economic entities, local consumption and local processing. The water available for future agricultural needs depends on proper planning for and reservation of irrigated lands, population changes and water demand, water conservation practices, legal and market conditions, and utilization of saline water. (Vernale-Omniplan)
W81-00643

AN ANALYSIS OF RESIDENTIAL WATER DEMAND SCHEDULES IN ARKANSAS,
Arkansas Univ., Fayetteville. Water Resources Research Center.
R. K. Ford, and J. A. Ziegler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142309, Price codes: A06 in paper copy, A01 in microfiche. Report, October, 1980. 123 p, 27 Fig, 4 Tab, 52 Ref.

Descriptors: *Arkansas, *Model studies, *Pricing, *Elasticity of demand, *Statistical models, *Water demand, *Forecasting, Consumptive use, Optimum development plans, Data collections, Profiles, Indicators.

Increases in population and water use require evaluation of the production and distribution of water, an economic good. Economic models are developed which identify the major factors affecting residential demand for water in each of the five Arkansas Water Resources Planning Areas. These factors include the price of water, price of other goods, water uses, financial resources of consumers, and quality of the water. The models are then used to estimate the effects of different rate policies on water demand and water system revenues. Information was gathered on prospective dependent variables using questionnaires mailed to individual households throughout Arkansas. The models are also capable of generating estimates of future water demand under changing conditions, and are useful in local, state, and national level planning of water pricing and public policy. (Garrison-Omniplan)
W81-00690

6E. Water Law and Institutions

REASONABLE GROUND WATER PUMPING LEVELS UNDER THE APPROPRIATION DOCTRINE: LAW, POLICY AND ALTERNATIVES,

Idaho Univ., Moscow. Coll. of Law.
D. L. Grant.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127540, Price codes: A06 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, University of Idaho Completion Report, September, 1980. 114 p, 222 Ref. OWRT-A-066-IDA(1), 14-34-0001-0114.

Descriptors: *Groundwater, *Water table, *Water supply, Water wells, *Pumping plants, Prior appropriation, *Legal aspects, Groundwater availability, Subsurface waters, Pumping, Appropriation, Appropriable waters, Public benefits, Public rights, Constitutional law, Local governments, States, State governments, Water policy, Hydrology, Hydrogeology, Surface-groundwater relationships.

This study noted that water agencies in most Western States have not been quick to issue pumping level regulations, and urged the development of regulations that would prevent pumping levels from dropping too far. The dilemma centers on the observations that (1) the determination of reasonable pumping levels depend much upon public consensus, (2) no public consensus has yet emerged, but (3) specific answers cannot be left to the future. Public participation was recommended not only to gather information, but to disseminate data that can assist in crystallizing public consensus. The overall study investigated what factors should be considered in setting reasonable pumping levels in appropriation doctrine States. Groundwater hydrology elements and other groundwater management tools that affect pumping levels in such States were described. Various reasonable pumping level statutes were compared and contrasted, and possible contribution of modern cost-benefit analysis to the setting of pumping levels was assessed. The need to integrate noneconomic or social goals as well was investigated. Finally, several alternatives to the reasonable pumping level approach were evaluated. (Zielinski-IPA)
W81-00510

REGIONAL FIVE-YEAR RESEARCH AND DEVELOPMENT PLAN FOR PERIOD 1982-1987. PACIFIC NORTHWEST/OCEANIA REGION.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-132110, Price codes: A02 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, November 1, 1980. 18 p, 6 Append.

Descriptors: *Research priorities, *Pacific Northwest U.S., *Alaska, *Guam, *Hawaii, Idaho, Oregon, Washington, Research and Development, Water Quality, Water supply, Groundwater, Water pollution, Streamflow, Coasts, Water use, Institutional constraints, Legal aspects, Anadromous fish, Fisheries, *Five-year plans.

This plan, prepared under the Directors of the Water Resources Research Center/Institutes of Alaska, Guam and Micronesia, Hawaii, Idaho, Oregon, and Washington, covers the 1982-1987 period for the Pacific Northwest/Oceanic region. Seven broad regional research objectives were identified. These cover methodology development to determine/evaluate instream flows, quantity and quality of groundwater resources, environmental/economic tradeoffs due to resource development; and evaluation of the effect of policies/laws pertaining to water allocations for native and Federal reserved land utilization, the effect of land/ocean resource use/development on coastal water quality, the effect of alternate energy development on water resource management/supply, and the effects of international/interstate laws on shared water resources. Identified special problems included the analysis of problems and issues affecting the ability to sustain current water uses, with particular attention to survival of anadromous fisheries. Research summaries of the six Centers/Institutes have been included as appendices. (Zielinski-IPA)
W81-00547

WATER RESOURCES RESEARCH NEEDS IN NEW ENGLAND,
Maine Univ. at Orono. Land and Water Resources Center.
S. S. Hasbrouck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131146, Price codes: A02 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, November, 1980. 17 p.

Descriptors: *Research priorities, *New England, *Water Resources, Research and Development, *Water quality, *Water supply, Connecticut, Maine, Massachusets, New Hampshire, Rhode Island, Vermont, Groundwater, Water pollution, Surface waters, Sewage effluents, Acidic water, Runoff, Flooding, Water conservation, Water management(Applied), *Five-year plans.

This report represented the New England regional summary, covering Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. A more thorough treatment of water research needs has been provided in the individual State reports. Water resource problems and associated research needs judged to be most critical from a broad New England regional perspective were assessed. Water resource problems affecting all New England States were categorized into water quality and water quantity issues. Water quality topics covered groundwater contamination/hazardous wastes; surface waters pollution by sewers; acid precipitation; runoff/lake eutrophication; recreation; and natural habitats protection. Identified water quantity topics were water supply and conservation; hydropower and other energy production; flooding and wetlands management; and allocation among competing demands. Technology transfer and information dissemination, regional allocation of water resources, and water resources and tourism were also considered. The widespread concern for groundwater management, acid rain, and institutional aspects of water resources management were identified as high priority candidates for regional emphasis. (Zielinski-IPA)
W81-00548

IMPLEMENTATION OF THE CONTROL OF POLLUTION ACT, 1974,
Severn-Trent Water Authority, Birmingham (England).
W. F. Lester.
Water Pollution Control, Vol 79, No 2, p 165-176, 1980. 1 Tab.

Descriptors: *Legislation, *Water pollution control, *Industrial wastes, *Sewage effluents, Municipal wastes, Pollution abatement, Water quality control, Pollutants, Water quality standards, Legal aspects, United Kingdom, Water Policy.

The Control of Pollution Act (COPA) was passed in Britain in 1974 and, although the segment dealing with waste disposal and the control of noise and of atomospheric pollution have been largely implemented, it will not be until 1980 that Part II, which cocerns water pollution, is implemented. Under the Act, the control of discharges of industrial and sewage effluent is extended to coastal waters and onto, as distinct from into, land. COPA provides for water authorities to renegotiate non-time-limited previous agreements made before 1937 concerning industrial effluent discharged into public sewers. Water authorities have the duty of stopping as soon as practicable pollution injurious to the fauna and flora of a stream produced as a consequence of a discharge, of arranging for the collection and disposal of waste from vessels, and of providing facilities for washing out sanitary appliances on vessels. The main benefit derived from the introduction of COPA will be in meeting the British government's desire for an open book approach to water pollution control work. The general public will be kept informed from advertisements relating to proposed significant new discharges and from public registers. A discussion follows the presentation of the paper. (McKeon-FRC)
W81-00579

HOW TO KEEP AHEAD OF THE REGULATORS,
Metropolitan Water District of southern California, Los Angeles.
V. E. Gleason.
Journal of the American Water Works Association, Vol 72, No 10, p 548-553, October, 1980. 1 Tab, 52 Ref.

Descriptors: *Legislation, *Water treatment, *Water districts, Regulation, Federal government, State governments, Local governments, Potable water, Water supply, Public utilities, Public health.

This article serves as a summary of regulations that deal with water supply systems. The purpose is to acquaint water system operators with the types of regulations that affect them. As government involvement increases, the amount of legislation and regulations will also increase. Water utilities must monitor more closely than ever the quality of drinking water supplies. Cooperation and significant evidence of attempts to improve working relationships with federal regulators can lead to protection against liability for damages resulting from unforeseen incidents which fall under the responsiblity of the regulator. Federal regulations discussed are the Safe Drinking Water Act of 1974, the Clean Water Act of 1977, The Clean Air Act, the Resources Conservation and Recovery Act, the Hazardous Materials Transportation Act, the Occupational Safety and Health Act of 1970, and the National Energy Conservation Policy Act of 1978. State and local regulations that are significant to water system supervisors include public utilities acts, state water supply statutes, environmental statutes, and water supply agreements. (Baker-FRC)
W81-00590

THE NEW REGULATORY CONSTRAINTS: FROM CONFLICT TOWARD COMPROMISE,
Black and Veatch, Dallas, TX.
H. J. Graeser.
Journal of the American Water Works Association, Vol 72, No 10, p 542-547, October, 1980.

Descriptors: *Legislation, *Water resources development, *Water law, Law enforcement, Legal aspects, Water supply, Water pollution sources, Administrative agencies, Regulation, Governmental interrelations.

Many laws have been passed in recent years dealing with the water industry and the development of water resources in the U.S. Such laws were often difficult to interpret and thereby created conditions conducive to adversary relationships between opposing government agencies, special interest groups, and the general public. Specific examples of conflicting interests and legal slowdowns are offered. The Limestone Reservoir experience illustrates how the provision of a wildlife reserve took priority over the supplying of drinking water to the people of the region. A second incident in Shreveport, Louisiana describes how delays endangered the area through inadequate drought yield and potential contamination of a single water supply reservoir. Some revision of section 404 has been achieved, mainly to the benefit of the Department of Agriculture and the farm lobby. Additional problems created by these laws are exemplified in the design constraints imposed by regulations directed against the supposed threat of cancer from trihalomethanes in drinking water. Possible federal aid in establishing reasonable programs is described. (Baker-FRC)
W81-00591

THREADING THE REGULATORY MAZE: A SMALL UTILITY'S VIEW,
Thornton, CO.
C. R. Palmer, L. J. Gronning, and W. F. Ketellapper.
Journal of the American Water Works Association, Vol 72, No 10, p 554-557, October, 1980. 1 Fig.

Descriptors: *Federal government, *Municipal water, *Legal aspects, *Water policy regulation, Reservoir sites, Permits, Legal aspects, Planning,

Costs, Local governments, Governmental interrelations, Water resources development, Colorado.

The relationship of small municipal water authorities to the federal government is examined through the experiences of Thornton, Colorado and several other communities in the Denver region. Thornton has considered building a reservoir, but a reservoir built on private land without federal funds requires only a dredge and fill permit and review by the state engineer, while the same reservoir built on federal land or using federal funds requires approval by eleven additional federal agencies and two congressional committees. Thornton's membership in a Denver sewer district has brought the city into regulatory relationships with the EPA that have resulted in a 27% increase in chemical costs (for chlorination of raw water, the quality of which deteriorated after the Metro sewage treatment plant was loccated two miles upstream of the supply) and a need to restructure rate schedules. The Army Corps of Engineers has been reluctant to allow Thornton to reclassify an existing flood control reservoir as a multipurpose storage reservoir. Other communities have exerienced similar problems with regulatory agencies, sometimes resulting in added expense, long delays in obtaining permits and grants, and delivery problems. Under the recently introduced National Water Policy, increased state control of water planning and conservation programs are viewed as positive, but a stress on protecting unique historical and environmental areas and a requirement to quantify federal and Indian reserved water rights are viewed as potentially problematic for small communities. (Just-FRC)
W81-00595

EFFICIENT GOVERNMENT INSTITUTION FOR WATER QUALITY CONTROL,
California Univ., Los Angeles.
F. L. Harder.
PhD dissertation, 1980. 100 p, 4 Fig, 6 Tab, 106 Ref, 17 Append.

Descriptors: *Government interrelations, *State governments, *Water law, *Economic efficiency, Model studies, Water quality standards, *Water pollution control, Efficiencies, Expenditures, Welfare(Economics), History, Stream gages, Water quality control.

The government budget on all levels has increased absolutely and relatively in America since World War II and a continually larger percentage of the nations's resources are managed or owned directly by the government sector. This study hypothesizes that new government institutions are set up as an efficient approach to welfare maximization in a changing society. Beginning with a discussion of Michigan water policy, an evaluation of government effectivess is made by studying water pollution control methods in all fifty states. A model of state behavior consistent with the welfare maximization theory is developed. Six hypotheses concerning efficient state behavior in the control of water quality are proposed, based on the assumptions of the model: (1) states supply collective goods for their constituents; (2) the federal effect is directed toward reduction of interstate externalities; (3) states with more water spend more per capita on water quality control; (4) the income elasticity for water quality expenditures is positive, but less than one; (5) states with more land spend less on water quality control; (6) states are guided by their constituents' preference functions. The hypotheses were tested using state expenditures data and data on the state utility and water quality control functions. All six hypotheses were confirmed. The study concludes that the welfare maximizing model is useful for explaining state water quality behavior and likely has much broader applications. (Garrison-Omniplan)
W81-00648

RECLAMATION LAW, WATER DISTRICTS, AND POLITICS IN THE KINGS RIVER SERVICE AREA OF CALIFORNIA - AN ALTERNATIVE FRAMEWORK FOR ANALYSIS,
California Univ., Los Angeles,
P. L. Ballard.
MS thesis, 1980. 107 p, 1 Fig, 11 Tab, 44 Ref. University of California, Los Angeles, Water Resources Center Archives.

Descriptors: *California, *Water rights, *Water law, *Local governments, *Government interrelations, *Federal reclamation law, Political constraints, Political aspects, Water resources development, Water districts, Central Valley project, Social aspects, Rivers, Irrigation, Reclamation.

California's history contains many accounts of bitter political struggles over water resource allocation. A case study of the Kings River Service Area is used to examine the predominance of political conflict as opposed to political consensus, ideological bias versus value-neutrality, and social group domination rather than public welfare as the major determinants of public water resource allocation. Three 'objective functions' of an 'irrigation community ' are hypothesized: popular participation, orderly conflict resolution, and local control. The conclusion is that the interests of large farmers are antithetical to the interests of the larger community whose residents receive little benefit from large-scale agricultural activities. Conditions of conflict are created which cannot be resolved within the framework of local political processes. A process is suggested to build the foundations for a reinterpretation of the politics of water that would include an analysis of political institutions, the relationship beween the state and the market, the economic relations of water resource management, and the consequences of specific strategies for regional and inter-regional development. (Garrison-Omniplan)
W81-00650

INSTITUTIONAL PROBLEMS OF WATER QUALITY PLANNING (SECTION 208) IN URBANIZING AREAS,
Phillips, Brandt, Reddick and Associates, Inc., Irvine, CA.
T. E. Smith, Jr., and B. Bruesch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-136541, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No 54-901, Prepared for Office of Water Research and Technology, October 1980. 65 p, 2 Fig, 7 Tab, 68 Ref. 3 Append. OWRT-C-90121-U(No 9432)(1), 14-34-0001-9432.

Descriptors: *Institutional constraints, *Legal aspects, *Water quality control, *Cities, *Federal Water Pollution Control Act, Water quality, Urban drainage, Urban runoff, Urbanization, Legislation, Water Quality Act, Water pollution, Surveys, Data collections, Evaluation, Census, Federal Government, Judicial decisions, Water law.

Institutional problems that occurred during development of areawide water quality management plans mandated by Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) were investigated. Definition of such problems included conflicts and general competition between governmental units. Telephone interviews with area Project representatives, and secondary materials, served to assess institutional-related problems in ten designated 208 areas, one from an urban or urbanizing area in each Federal Region. Identified institutional problems common to most areas studied were: (1) lack of implementing powers and authorities inherent in Councils of Governments, and the voluntary nature of member agency participation, offered difficulties to effective institutional arrangements: (2) most designated management agencies were reluctant to finance measures for nonpoint pollution sources abatement; and (3) small towns and special purpose districts lacked commitments to implement 208 plan recommendations due to financial/attitudinal reasons for future research on institutional problems were delineated. (Zielinski-IPA)
W81-00672

FIVE YEAR PLAN OF WATER RESOURCES RESEARCH AND DEVELOPMENT FOR CONNECTICUT,
Connecticut Univ., Storrs. Inst. of Water Resources.
R. Young.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142291, Price codes: A04 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October 1980. 58 p, 7 Fig, 13 Ref.

Descriptors: *Research priorities, *Connecticut, *Research and Development, *Water resources, Water quality, Water supply, Lakes, Rivers, Groundwater, Water conservation, Water pollution, Water management(Applied), Acidic water, Potable water, Waste water(Pollution), Wetlands, Leachates, Soils, Toxins, Institutions, *Five-year plans.

The dominant concern for Connecticut was identified as the need for improvement, control, and protection of its existing potable water sources, in addition to the prevention of further damage to water quality of lakes, rivers and groundwater by undesirable wastes coupled to efforts to clean up water quality impairment sources. The most complex areas for research were identified as those dealing with institutional, economic and legislative matters. Many of these must be resolved prior to application of existing technical solutions. Identified problems resided in the areas of surface and groundwater quality and quantity, natural resources and ecology, insitutional coordination and legislation, and technology related to lake restoration. Fourteen principal research topics were priority-ranked, led by economic/institutional relations for aquifer protection, incentives for water use conservation, and industrial wastes disposal/ treatment. The 14 topics were reduced by combination into seven research categories: acid precipitation; water resources allocation; drinking water and waste water; groundwater; lakes and wetlands; leachates and soils; and toxic and hazardous materials. Two funding allocations plans were developed for the research program elements. (Zielinski-IPA)
W81-00675

INSTITUTIONAL AND LEGAL PRESCRIPTION OF WATER USE AND MANAGEMENT,
Indiana Univ., Indianapolis. School of Law.
J. P. White.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138042, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, Purdue University, West Lafayette, Indiana, Technical Report, September, 1980. 80 p, 2 Tab, 2 Append. OWRT-C-2172(No 3405)(1).

Descriptors: *Institutional constraints, *Legal aspects, *Water use, *Water law, *Indiana, Water policy, Riparian rights, Institutions, Governments, Water rights, Judicial decisions, Federal Government, States, Lakes, Water levels, Water level fluctuations, Navigable waters, Streambeds, Water users, Legislation.

Indiana has one of the most comprehensive State water regulatory systems. This report surveyed Indiana statutes and court decisions governing water use, and has highlighted deficiencies within this network that could lead to unnecessary future litigation. Indiana code definition of a public fresh water lake could unjustly affect riparian landowners rights. The Indiana lake water level statute requires modification providing more definite criteria in determining average water levels, and to specifically include/exclude non-riparians who may affect or be affected by lake levels, such as drainage basin owners. Other needs areas included definition of a navigable stream; and interpretation of what constitutes domestic use. There has been little incidence of case law interpreting the water law statutes. This study concluded that, while Indiana courts possess the power to construe statutes when needed, interpretations or modifications of the statutes made now by the general assembly could eliminate the possiblity of many cases ever arising. An overview of the Indiana water law system was presented, with recommendations/suggestions for system improvements to assure that State future water needs are met. (Zielinski-IPA)
W81-00678

FIVE-YEAR RESEARCH PLAN,
Maine Univ. at Orono. Land and Water Resources Center.
S. S. Hasbrouck, and P. D. Uttormark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138026, Price codes: A03 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October, 1980. 25 p, 3 Tab, 34 Ref.

Descriptors: *Research priorities, *Maine, *Planning, *Research and Development, *Water resources, Groundwater resources, Acidic water, Water quality, Water pollution, Lakes, Water wells, Water pollution effects, Wetlands, Recreation, Recreation facilities, Rivers, Water conservation, Water use, Water demand, Legal aspects, *Five-year plans.

This research plan was developed under the auspices of the Maine Land and Water Resources Council, with the Council's Subcommittee on River Basin Planning serving as the primary advisory group. The study was limited to freshwater resources, with emphasis on management-oriented research. Information from 39 interviews and relevant reports led to the identification of five major areas and associated subareas: (1) groundwater management (water quality of private wells; land use loadings to groundwater; long-term and cumulative effects of contamination on groundwater systems); (2) acid precipitation; (3) lake management (conservation and aesthetic protection of developing lakes; protection of 'wilderness' lakes; water quality protection and enhancement); (4) river, stream, and wetlands management (impacts of expanding hydropower; agricultural impacts; impacts of forest spraying; stormwater impacts); and (5) recreational use of Maine's inland waters (public/private conflicts; recreation potential; recreational carrying capacities). Each of these subareas has been evaluated under the categories of (1) problem or situation; (2) what is being done; (3) research needed; and (4) questions to be answered. Groundwater management and acid precipitation were identified as areas of highest research priority. Projected annual fiscal allocations for the cooperative program over the 1982-1986 timescale were also developed. (Zielinski-IPA)
W81-00683

1982-1986 RESEARCH AND DEVELOPMENT PLAN FOR FLORIDA WATER RESOURCES RESEARCH CENTER,
Florida Univ., Gainesville. Water Resources Research Center.
J. P. Heaney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138018, Price codes: A07 in paper copy, A01 in microfiche. Publication No 51, submitted to the Office of Water Research and Technology, October, 1980. 119 p, 16 Fig, 11 Tab, 51 Ref, 1 Append.

Descriptors: *Research priorities, *Florida, *Research and Development, *Water resources development, *Planning, Groundwater, Flood plains, Flooding, Saline water intrusion, Wetlands, Water pollution sources, Water quality, Water conservation, Drainage, Evaluation, Cost analysis, Institutions, Governments, Legal aspects, Institutional constraints, State Governments, *Five-year plans.

This research and development plan, developed from a variety of information resources, identified research needs in five categorical areas. The five identified areas (and the highest priority research needs in each respective area) were: (1) Atmospheric, Hydrologic and Hydraulic Processes (pollutants to groundwater, flood plains management, and saline intrusion); (2) Hydrologic-Ecologic Relationships (wetlands, lake and reservoir quality, non-point sources, and acid rain); (3) Water Quality Monitoring and Protection (water treatment processes); (4) Water Development, Use, Conservation, and Management (water conservation in industry and agriculture, and drainage); and (5) Institutional and Economic Analysis and Water Resources Planning (floods, integrating water and land use management, legal constraints, and control of water use). Florida's rainfall (annual average of 56 inches) replenishes streamflow and groundwater aquifers, with the Foridian aquifer serving as the major water supply source for the State. Much water movement in southern Florida is regulated by control structures, the largest State project of which is the Central and Southern Florida Flood Control Project. Close to seven billion gallons of water are withdrawn daily, about equally from surface sources and groundwater; and used for irrigation (42%), thermoelectric power generation (24%), public supply (16%), industrial purposes (14%), and rural supply (4%). (Zielinski-IPA)
W81-00684

A FIVE YEAR WATER RESEARCH PLAN FOR THE STATE OF ARKANSAS,
Arkansas Water Resources Research Center, Fayetteville.
R. E. Babcock.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142283, Price codes: A04 in paper copy, A01 in microfiche. Publication No 72, submitted to the Office of Water Research and Technology, August, 1980. 45 p, 9 Tab.

Descriptors: *Research priorities, *Arkansas, *Planning, *Research and Development, *Water resources, Water resources development, Water quality, Groundwater, Water pollution, Mining, Aquifers, Waste water(Pollution), Legal aspects, State Governments, Institutions, Industrial wastes, Institutional constraints, Agriculture, Recreational facilities, Water demand, *Five-year plans.

Competing water resource needs in Arkansas fell into three major categories: agricultural activities; recreational and resort development; and municipal and light industry. Heavy industry (lignite mining and other energy-related processes) represents near-future water resource needs. Management of State water needs will depend on a consistent and available data base in concert with a functional institutional framework. Identified research priorities over 1980-1985 for the Arkansas Water Resources Research Center were summarized under four water categories established by the Commission on Natural Resources, National Research Council: (1) Atmospheric, Hydrologic, and Hydraulic Processes: hydrologic characteristics of the Vadose zone; and hydrologic inputs to water quality monitoring; (2) Ecological-Environmental Relationships: effects of contamination on aquatic ecosystems; (3) Water Quality Protection: waterborne virus research; and control of contaminants resulting from energy development, including lignite mining; and (4) Water Resource Management: comprehensive data base in information dissemination system development; and institutional framework studies on alternative ways of moderating conflicting water use needs. Six principal goals were identified for the Arkansas Water Research Center for the 1980-1985 period, including a comprehensive study of nutrient/sediment loading on Beaver Reservoir in northwest Arkansas and its impacts, and of waste water impacts on groundwater aquifers and impoundment eutrophication. (Zielinski-IPA)
W81-00693

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN: FISCAL YEARS 1982-1986.
Washington State Water Research Center, Pullman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142259, Price codes: A03 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October, 1980. 41 p, 2 Fig, 4 Tab, 47 Ref.

Descriptors: *Research priorities, *Washington, *Planning, *Research and Development, *Water resources, Water resources development, Water quality, Water quantity, Groundwater movement, Volcanoes, Water pollution, Water pollution sources, Legal aspects, State Government, Institutions, Institutional constraints, Fisheries, Toxicity, Pollutants, Water use, *Five-year plans.

Use of the State of Washington's water resources and identified water resource problems were summarized under water quantity, hydroelectric production, flooding potential, water quality concerns, waste disposal, groundwater and lake water quality, community water supplies, industrial concerns, fisheries, wild/scenic rivers, recreation, and effects of Mt. St. Helens. Research needs were assigned Highest, Intermediate, or Lowest priority rankings, based on specific ranking criteria. Those having highest priority rankings were identified under five research areas: (1) effects of Mt. St. Helens' eruption (toxic effects on salmon/steelhead fisheries; chemistry/products occurring in watersheds/waterways of devastated areas; watershed characteristics in devasted/ash-impacted areas; study of mud flow mechanics); (2) water quantity problems (irrigation conservation methods; groundwater movement and contaminant dispersion; dam safety; basic hydrologic/hydraulic studies); (3) water quality problems (measurement of pollutants entering major freshwater streams in urban/agricultural areas and major State groundwater aquifers; long-term accumulative effects on aquatic ecosystems; small hydroelectric development impacts); (4) institutional problems (studies on Federal-State conflicts on hydroelectric/agricultural development and fisheries survival; Indian reservations water use potential); and (5) fisheries problems (effects of river operations methods on anadromous fisheries; fishery habitat rehabilitation; mortality reduction for downstream migrants). (Zielinski-IPA)
W81-00694

REGIONAL FIVE-YEAR WATER RESEARCH AND DEVELOPMENT GOALS AND OBJECTIVES.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137952, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institutes, Missouri River Basin States, Report submitted to the Office of Water Research and Technology, November 1980. 84 p, 14 Fig.

Descriptors: *Research priorities, *Missouri River, River basin, States, *Regional analysis, Planning, *Research and development, *Water resources, Water resources development, Water quality, Surface-groundwater relationships, Water conservation, Water utilization, Sediments, Pollutants, Irrigation efficiency, Institutions, State governments, Legal aspects, Institutional constraints, Wetlands, Riparian rights, *Five-year plans.

This coordinated regional plan for 1982-87 was prepared by the Directors of the Water Resources Research Institutes/Centers in the Missouri River Basin States (Iowa, Kansas, Missouri, Montana, Nebraska, North Dakota, South Dakota, Wyoming) that had each prepared five-year research and development plans. Thirty-eight regional problem areas were identified under six water research categories (water quantity, water quality, institutional water problems, utilization and conservation of water, energy-water relations, and ecological-environmental relationships in water resources). Fifteen of these problems were judged as highest priority for immediate attention: basin water distribution; groundwater systems and groundwater-surface water interaction dynamics; sediment; nonpoint pollution sources; State water development goals; control/ownership of waters; ground/surface water allocation; efficient water use in food/fiber production; lack of institutional incentives for conservation; conservation impacts on hydrologic systems; irrigation energy costs; energy development water needs; instream flow needs; wetlands hydrology dynamics; and sediments/pollutants impacts on aquatic/riparian ecosystems. Estimated funding percentages in the six research categories of the annual cooperative program for the eight regional States were developed. (Zielinski-IPA)
W81-00699

WATER RESOURCES RESEARCH PROGRAM: FIVE-YEAR PROJECTION (1982-1986), PENNSYLVANIA WATER RESOURCES RESEARCH CENTER,
Pennsylvania State Univ., University Park. Inst

for Research on Land and Water Resources.
A. J. McDonnell, and W. K. Hood, III.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142275, Price codes: A04 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, December 1980. 52 p, 6 Fig, 15 Tab, 25 Ref, 2 Append. 14-34-0001-0140.

Descriptors: *Research priorities, *Pennsylvania, *Planning, *Research and development, *Water resources, Water quality, Water quantity, Water pollution, Water pollution sources, State governments, Institutions, Legal aspects, Institutional constraints, Waste water(Pollution), Waste water treatment, Acid mine water, Mine drainage, Waste disposal, *Five-year plans.

Significant issues identified relevant to water quality included groundwater pollution; non-point source pollution from acid mine drainage and other sources; environmental response/impact; and pollution control technology. Water quantity-related issues included stormwater drainage; floods; and surface/groundwater availability, supply, and use. The identified five-year research projections (1982-1986) included recommended programs in non-point source prediction and control; acid mine drainage control; acid precipitation; mine spoils reclamation; land cycling of wastes; treatment technology (including on-lot disposal); environmental assessment; stormwater management; in-stream needs; water conservation; groundwater management; and water allocation. Social, legal, economic, and other institutionally-related aspects pertinent to these areas were considered. Final specific activities fall under 11 Program Activity areas, covering floods, stormwater drainage, water supply, groundwater supply, environmental effects (including models), non-point source pollution, land disposal of wastes, energy/water interface, treatment technology, planning and management, and basic research - high risk. Waste water treatment and reuse is the highest funded present program area (32.7%) among seven other current program areas. (Zielinski-IPA)
W81-00700

6G. Ecologic Impact Of Water Development

PROMISING METHODOLOGIES FOR FISH AND WILDLIFE PLANNING AND IMPACT ASSESSMENTS,
Fish and Wildlife Service, Denver, CO.
L. R. Porter, G. W. Towns, L. W. Carlson, J. F. Hamill, and V. F. Fresquez.
Report, October 1979. 35 p, 8 Fig, 3 Tab, 5 Ref, 2 Append.

Descriptors: *Wildlife habitats, *Water resources development, *Coal mines, *Mapping, Planning, Methodology, Computer programs, Environmental effects, Fish, Stream fisheries, Reservoirs, Streamflow, Colorado, Yampa River basin.

The purpose of this study was to develop capabilities to: address incremental and cumulative impacts on fish and wildlife of multiple development actions in basin-wide settings, and evaluated alternative development scenarios from the standpoint of impacts on fish and wildlife. The Yampa River basin in northwest Colorado was used as the study area. Tools and methods described include a computerized Geographic Information System (GIS), conflict mapping, ranking of project impacts, and prediction of fish habitat changes resulting from multiple water developments. The GIS allowed manipulation and analyses of mapped information that would have been impractical manually. Mapped wildlife data were composited to determine habitat values of land units in the study area. Proposed locations of coal and water developments were overlaid on the composited wildlife maps to identify potential conflicts. A method was devised to quantify and compare relative impacts of different development scenarios on wildlife. A reservoir-streamflow analysis was initiated to predict changes in stream fisheries habitat resulting from proposed water developments. (Moore - SRC)
W81-00565

ECOLOGICAL COMPARISON OF INTERMITTENT STREAMS IN DIFFERENT LAND USE PATTERNS IN NORTHEASTERN ILLINOIS,
Louisville Univ., KY. Systems Science Centre.
For primary bibliographic entry see Field 2E.
W81-00645

7. RESOURCES DATA

7B. Data Acquisition

APPLICATIONS OF REMOTE SENSING IN HYDROLOGY,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
W. D. Striffler, and D. C. Fitz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127425, Price codes: A05 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report No 99, September, 1980. 76 p, 14 Fig, 3 Tab, 100 Ref, 2 Append. OWRT-B-160-COLO(7).

Descriptors: *Remote sensing, *Hydrology, Surface waters, Subsurface waters, *Aerial photography, Watershed characteristics, *Satellites(Artificial), Wetlands, Snow cover, Water quality, Soils, Vegetation, Mapping, Available water, *Instrumentation, *Landsat.

This paper is a summary of the potential applications of remote sensing in the field of hydrology. It includes an introduction to remote sensing, the physical principles of electromagnetic energy and many of the available sensors. Operational uses and research applications of remote sensing in areas related to watershed management are summarized.
W81-00505

A WATERSHED INFORMATION SYSTEM,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
A. G. Thomsen, and W. D. Striffler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127433, Price codes: A07 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University Completion Report 100, September 1980. 97 p, 57 Fig, 34 Tab, 19 Ref. OWRT-B-160-COLO(8).

Descriptors: *Remote sensing, *Model studies, *Mountain watersheds, Hydrology, Snowmelt, Runoff forecasting, Topography, Vegetation, Soils, Forest management, Watersheds(Basins), Mapping, *Colorado, *Rocky Mountains, *Landsat.

A watershed information system for the analysis and simulation of mountain watersheds is described. Watershed information on topography, vegetation and soils in digital terrain models (overlays) serve as the data base for watershed analysis, classification of snow in Landsat imagery and automatic generation of parameter decks for operating distributed simulation models of snowcover dynamics and streamflow generation. The computer programs that generate the parameter decks have built-in calibration options for all major processes, that permit fast model calibration from an interactive computer terminal, on watersheds with varying characteristics. Options are available for simulating the effects of forest management alternatives (thinning, clearcutting) on selected forest stands. Snow course measurements and Landsat imagery are used for simulation update. Examples of output from subsystems are included to illustrate the capabilities of the information system.
W81-00506

BASE PEAK PROFILES OF GAS CHROMATOGRAPHY-MASS SPECTROMETRIC DATA OBTAINED FROM THERMAL DESORPTION OF ACTIVATED CARBONS,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
K. Alben.
Analytical Chemistry, Vol 52, No 12, p 1821-1824, October, 1980. 3 Fig, 1 Tab, 18 Ref.

Descriptors: *Adsorption, *Activated carbon. *Waste water treatment, *Gas chromatography, *Spectrophotometry, Liquid wastes, Water quality control, Data storage and retrieval, Engineering, Sampling, Computer models, Organic wastes, Volatility, Thermal properties, Chemical properties, Analytical techniques.

Thermal desorption gas chromatography-mass spectrometry is a sensitive specific method for analyzing volatile compounds. It has potential application in monitoriing the abundance and chemical composition of organic substances removed by adsorption onto activated carbon in waste water treatment. This method produces electron impact data and chemical ionization data which can be stored in two-dimensional base peak format. Such data reveals the chemical identity of organic compounds and can be used by engineers and chemists. The format is useful in comparative studies and for historical profiles. In samples drawn from water treatment plants, major contaminants were identified from 0.1 g of carbon. This method is more sensitive than the carbon chloroform extraction method, and it can be applied to more volatile compounds. Its disadvantage is the complexity of the data which requires an on-line computer for acquisition, storage, and interpretation. (Titus-FRC)
W81-00569

DETERMINATION OF CHEMICAL OXYGEN DEMAND USING AN OPEN-TUBE METHOD,
Yorkshire Water Authority, Leeds (England). Office of Scientific Services.
K. E. De Casseres.
Water Pollution Control, Vol 79, No 1, p 143-145, 1980. 4 Tab, 7 Ref.

Descriptors: *Chemical oxygen demand, *Analytical techniques, *Testing procedures, *Laboratory equipment, Safety factors, Aromatic compounds, Laboratory tests, Methodology, Statistics, Water vapor, Volatility, Sewage treatment, Digestion, Oxygen requirements, Water quality, Pollutants, Water analysis.

COD of water samples was determined by a semi-micro open-tube method. Results were compared with those obtained by a conventional sealed-tube method. Tests for precision, percent recovery using synthetic COD standards, recovery of volatile compounds, and COD determined in real samples showed that the open-tube method is comparable to the closed-tube method with safer operating capabilities. For example, mean by analysis in mg/liter of potassium hydrogen phthalate samples with a theoretical COD of 800 mg/liter was 789 by open tube and 809 by sealed tube; corresponding figures for percent recovery were 98.6 and 101.1%. Mean recovery by open tube and sealed tube, respectively, of ethanol (500 mg/liter) was 479 and 481, of methyl-iso-butyl ketone (700 mg/liter) was 644 and 639, and of acetone (500 mg/liter) was 463 and 458. Mean COD in mg/liter in real samples by open and sealed tubes, respectively, was 265 and 275 for domestic crude sewage and 304 and 314 for industrial crude sewage. In addition, the open-tube method may be conducted using larger tubes (26 mm) and cones to permit in situ titration. However, smaller tubes offer more advantages when large numbers of COD analyses must be carried out. (Geiger-FRC)
W81-00571

AUTOMATED DISTILLATION-SPECTOPHOTOMETRY PROCEDURE FOR DETERMINING AMMONIA IN WATER,
Ontario Ministry of the Environment, Rexdale, Water Quality Branch.
For primary bibliographic entry see Field 5A.
W81-00576

AN EMPIRICAL KINETIC MODEL OF TRIHALOMETHANE FORMATION: APPLICATIONS TO MEET THE PROPOSED THM STANDARD,

Montgomery (James M.), Inc., Pasadena, CA.
For primary bibliographic entry see Field 5F.
W81-00596

BLANKING SYSTEM FOR THE SPECTROPHOTOMETRIC DETERMINATION OF AMMONIA IN SURFACE WATERS,
Ontario Ministry of the Environment, Rexdale. Water Quality Branch.
For primary bibliographic entry see Field 5A.
W81-00598

ON-COLUMN CRYOGENIC TRAPPING OF SORBED ORGANICS FOR DETERMINATION BY CAPILLARY GAS CHROMATOGRAPHY,
Washington Univ., Seattle Dept. of Environmental Health.
D. Kalman, R. Dills, C. Perera, and F DeWalle.
Analytical Chemistry, Vol 52, No 12, p 1993-1994, October, 1980. 3 Fig, 8 Ref.

Descriptors: *Gas chromatography, *Separation techniques, *Cryogenics, *Organic compounds, Analytical techniques, Design data, Collants, Laboratory test, Waste water, Sludge, Mass spectrometry, Condensation, Water analysis.

A simple on-column cryogenic trap for capillary analysis which can be made from common materials is described. The trap can be used for the purge-and-trap analysis of waste water and sludge samples by capillary column gas chromatography when the sample is complex and additional resolution is required. Three different cold trap designs were tested; all three used liquid nitrogen as the coolant. The first (design A) used copper as the trap, the second (design B) used aluminum plates and the third (design C) used stainless steel tubing. All three designs were mountable form a central support or could be supported by the liquid nitrogen supply tube. Each covered about 10 cm of the column providing a residence time of about 0.2 seconds for flow rates between 1 and 2 ml/minute. Thirty-four samples representing all of the EPA priority purgables except arolein and acrylonitrile were tested on the three traps and were analyzed by gas chromatography. Results from design A showed poor peak shape Lnd occasional split peaks for compounds more volatile than dichloromethane. Design B gave satisfactory resolution but its equipment was considered too cumbersome to install. Design C offered good resolution performance plus ease of installation to capillary columns. The flow of coolant and air to and from the trap can be readily automated. This cryogenic trap may also be used for headspace analysis and for determining concentrations of organics form large gas samples. (Geiger-FRC)
W81-00600

DETERMINATION OF ALPHA-CHLOROACETANILIDES IN WATER BY GAS CHROMATOGRAPHY AND INFRARED SPECTROMETRY,
Monsanto Agricultural Products Co., St. Louis, MO. Research Dept.
J. W. Worley, M. L. Rueppel, and F. L. Rupel.
Analytical Chemistry, Vol 52, No 12, p 1845-1849, October 1980. 9 Fig, 2 Tab, 9 Ref.

Descriptors: *Water analysis, *Gas chromatography, *Spectrometry, *Alpha-chloracetanilides, Chemical analysis, Herbicides, Water quality, Regression analysis, Analytical techniques, Statistical methods, Water pollution sources.

General sampling and analytical methods for determination of members of the herbicidal alpha-chloroacetanilide class at low ppb levels (0.5-14.3 ppb) in water are reported. The method includes extraction of a water sample with methylene chloride, concentration and solvent exchange for toluene/methanol, and gas chromatographic (GC) analysis. Quantitation is done by a nitrogen-selective detector. Structural confirmation is by on-the-fly GC-infrared (GC-IR) spectrometry. Recovery and linearity of response for each of the seven acetanilides investigated by nitrogen-selective GC from low ppb levels up to 100-300 ppb levels were found to be excellent. The method was rigorously validated in the 0.2-10 ppb range. GC-IR spectrometry provided useful chemigrams (time-dependent plots of the infrared absorbance integrated over a chosen frequency range) and characteristic infrared spectra from mixtures containing 1.0 micrograms of each of the acetanilides tested. GC-IR is therefore a viable tool for confirming structures of acetanilides in water at low ppb levels. (McKeon-FRC)
W81-00601

GAS CHROMATOGRAPHIC-MASS SPECTROMETRIC ANALYSIS OF CHLORINATION EFFECTS ON COMMERCIAL COAL-TAR LEACHATE,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
K. Alben.
Analytical Chemistry, Vol 52, No 12, p 1825-1828, October, 1980. 5 Fig, 1 Tab, 23 Ref.

Descriptors: *Chlorination, *Organic compounds, *Coal tar coatings, *Potable water, Halogens, Leachate, Water pollution sources, Chemical reactions, Water analysis, Gas chromatography, Mass spectrometry, Laboratory tests, Analytical techniques, Linings.

Mass spectrometric analyses suggest that chlorination significantly modifies the distribution of polycyclic aromatic hydrocarbons (PAH) in samples of commercial coal-tar leachate. Coal tar is often used as a lining for storage tanks and pipes in water supply systems. Analyses of mutagenic base-neutral compounds were conducted for laboratory samples of coal-tar leachate and chlorinated coal-tar leachate. The chlorinated samples revealed diminished concentrations of phenanthrene and fluoranthene and the absence of higher-molecular-weight PAH. Fluorene became prominent, oxygen-substituted PAH increased, and new oxygenated compounds were found. Intermixed with these were low concentrations of chlorine- and bromine-substituted PAH. Such chlorine and bromine compounds have also been found in investigations of chloroform produced by chlorination of potable water. Chlorination of coal-tar leachate is further expected to result in the formation of PAH with polar acidic function groups. Further studies of potable water systems for evidence of coal-tar contamination should benefit by screening for effects observed experimentally. (Titus-FRC)
W81-00603

ON THE VALIDITY OF THE CODISTILLATION MODEL FOR THE EVAPORATION OF PESTICIDES AND OTHER SOLUTES FROM WATER SOLUTION,
Oregon State Univ., Corvallis. Enviromental Health Sciences Center.
C. T. Chiou, and M. Manes.
Environmental Science and Technology, Vol 14, No 10, p 1253-1254, October, 1980. 6 Ref.

Descriptors: *Distillation, *Pesticides, *Model studies, *DDT, *Polychlorinated biphenyls, Evaporation, Water vapor, Vapor pressure, Aqueous solutions, Chlorinated hydrocarbon pesticides, Solutes, Gas chromatography, Analytical techniques, Laboratory tests.

Evidence is presented to demonstrate that the codistillation model is invalid when chemical-water mixtures are evaporated in a highly humid or supersaturated atmosphere. The model was originally supported by agreement of results from conventional steam distillation calculations with data on evaporative loss rates of pesticides and water. The present study showed that rapid evaporative loss of some low-vapor-pressure compounds from water is not always due to codistillation. When a stream of air maintained at 25C and a relative humidity of 98% was passed over water containing DDT, after 64 hours, the solution gained 412 g of water and lost 76% of its DDT by evaporation. Similarly, an aqueous solution of PCB at 0-2C gained 45 mg of water and lost 20% of its PCB when left for 6 hours in ambient air 0f 25C and 36% relative humidity. Since the evaporative loss of water and solute may occur independently of each other, it was suggestd that another term besides codistillation be used to describe such evaporative losses so that mechanistic coupling of two separate processes will not be assumed. (Geiger-FRC)
W81-00604

WATER SOLUBILITY AND OCTANOL/WATER PARTITION COEFFICIENTS OF ORGANICS. LIMITATIONS OF THE SOLUBILITY-PARTITION COEFFICIENT CORRELATION,
Syracuse Research Corp., NY. Life Sciences Div.
S. Banerjee, S. H. Yalkowsky, and S. C. Valvani.
Environmental Science and Technology, Vol 14, No 10, p 1227-1229, October, 1980. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Solubility, *Mathematical models, *Organic wastes, Water pollution, Adsorption, Water quality, Standards, Laboratory tests, Volatility, Aromatic compounds, Analytical techniques, Organic compounds, Equations.

The 1-octanol/water partition coefficient (K) has been used extensively in environmental fate studies to predict biological and physical phenomena such as bioaccumulation and soil adsorption. The water solubility (S) and K values for 27 organic compounds from the list of 65 Consent Decree Chemicals for which the US EPA is currently recommending water-quality criteria were determined from radioactively labeled samples. Results showed that the previously described Chiou correlation between K and S was not always valid for solids with high melting points. It was recommended that estimations of K or S for liquids should be made using the Hansch correlation. Another equation was proposed for estimating K or S for solids with known melting points. When the melting point is not known, the estimate may be made from an average value of KS obtained from compounds of similar structure. Tests with the high-melting compound RDX demonstratd that a serious error may result when Chiou's correlation is applied indiscriminantly for the determination of K or S (Geiger-FRC)
W81-00605

INTRODUCTION (SPECIAL ISSUE ON THE PROGRESS OF AN ON-GOING PROGRAM TO IMPROVE METHODOLOGIES FOR THE ANALYSIS OF PRIORITY POLLUTANTS IN WASTE WATER EFFLUENTS),
Villanova Univ., PA.
R. L. Grob.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 379-391, 1980.

Descriptors: *Pollutant identification, *Analytical techniques, *Data collections, Water pollution sources, Environmental Protection Agency, Separation techniques, Gas chromatography, Industrial wastes, Legislation, Methodology, Waste water(Pollution), Effluents.

A special issue of the journal is devoted to reporting progress in an on-going program to improve analysis methodologies for priority pollutants in industrial waste water effluents. Relevant legislation and the history of the Organic Chemicals Branch of the EPA in developing regulatory guidelines and applicable methodologies are reviewed. A program devised to develop the Best Available Control Technology Economically Achievable (BAT) analytical data base incorporates screening to determine which of the 129 priority pollutants are present, verification to quantify the pollutant load of industrial products/processes and the performance of treatment systems, and self-monitoring to extend the first two stages by adding time depth to the data base. Methods have been published in the Federal Register. Validation of analytical procedures used in these methods, especially in verification, requires the development of new techniques suited to specific matrices. Gas chromatography/conventional detector methodology was selected for verification because it allows generally superior quantification via recovery data, it is more cost effective for samples containing few priority pollutants, it allows faster laboratory turnaround, and instruments and qualified personnel are widely available. Performance and cost expectations have proved accurate. All 13

methods for 14 classes of organic priority pollutants use microextraction, headspace, or purge and trap (heated/unheated) extraction techniques. Cooperation among industry, private laboratories, and government agencies emerges as a dominant theme in this program. (Just-FRC)
W81-00609

AN AUTOMATED METHOD FOR THE SIMULTANEOUS DETERMINATION OF NITROGEN AND PHOSPHORUS IN PLANT MATERIAL, SLUDGE AND SOIL,
Water Research Centre, Stevenage (England).
K. W. Petts, and M. Belcher.
Water Pollution Control, Vol 79, No 3, p 399-404, 1980. 1 Fig, 6 Tab, 1 Ref.

Descriptors: *Analytical techniques, *Colorimetry, *Phosphorus, *Nitrogen, Spectrophotometry, Ammonia, Phosphorus compounds, Sludge, Soil analysis, Nutrients, Chemical analysis, Plant tissues, Sewage sludge, Digestion, Sampling.

This semi-automated method for the determination of nitrogen and phosphorus involves controlled digestion with sulfuric acid of up to 40 samples in a thermostatically regulated heating block, followed by automatic colorimetric analysis of the digest solutions for both amonia and orthophosphate concentrations. Nitrogen and phosphorus are determined in concentration ranges of 0-2.25% and 0-0.75% respectively. Materials with greater concentrations of these elements can be diluted. The method is discussed in detail with a description of the pretreatment of samples, digestion procedure, presision, accuracy, standards, reagents, and analytical procedure. Where the color of the acid digest solution may influence the calculated phosphorus content, a correction may be applied by using a conversion table. Since it is difficult to produce standard samples of plant material, sludge, and soil, it is suggested that the standard samples should be samples of the material being investigated. Using this analytical procedure, one analyst can run 80 samples per day. (McKeon-FRC)
W81-00622

BIOOXIDATION IN A CONTINUOUS ACTIVATED SLUDGE PROCESS,
Instytut Kształtowania Środowiska, Katowice (Poland). Dept. of Water and Wastewater Treatment.
J. Suschka.
Water Research, Vol 14, No 3, p 197-205, March, 1980. 14 Fig, 6 Tab, 16 Ref.

Descriptors: *Oxidation, *Activated sludge, *Mathematical models, Biodegradation, Bilogical treatment, Chemical degradation, Waste water treatment, Equations.

An extensive examination of the biochemical oxidation rate theory in the activated sludge process has suggested the need for a new critical equation to relate the overall biochemical reaction rate on the activated sludge to the oxidation process. The new equation which was based on many years of laboratory tests, pilot studies, and full scale experiements, calculates the substrate removal rate as a function influent and effluent substate concentration and detention time. Application of the equation showed that the overall reaction rate of sludge biochemical oxidation was not dependent on the substrated concentration in the effluent. Results of treatments by single and multistage activated systems may be predicted from the proposed equation. It seems feasible that the suggested equation may be used in process modelling because of its proven validity in wide ranges of activatd sludge loads. However, a commentary on the proposed new equation points out that the evidence to back up the mathematical model proves poor in most cases and this solution to the problems of measuring the kinetics of biodegradation may be illusory. (Geiger-FRC)
W81-00624

EUTROPHICATION IN PEEL INLET-I. THE PROBLEM-DEFINING BEHAVIOR AND A MATHEMATICAL MODEL FOR THE PHOSPHORUS SCENARIO,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5A.
W81-00725

SENSORY PROPERTIES AND ANALYSIS OF TWO MUDDY ODOUR COMPOUNDS, GEOSMIN AND 2-METHYLISOBORNEOL, IN WATER AND FISH,
Helsinki Univ. (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5A.
W81-00748

7C. Evaluation, Processing and Publication

A LABORATORY DATA-PROCESSING SYSTEM,
Severn-Trent Water Authority (England). Upper Trent Div.
D. R. Woods, M. D. Frayn, and R. S. Walker.
Water Pollution Control, Vol 79, No 1, p 42-55, 1980. 3 Fig, 6 Tab, 4 Ref.

Descriptors: *Computer programs, *Data storage and retrieval, *Data processing, *Laboratory tests, *Water sampling, Data collections, Monitoring, Water analysis, Measurement, Chemical analysis, Automation.

An experimental laboratory data-processing system provides a controlled method for the calculation of analytical results from raw data and for compiling routine analytical reports on sewage effluent samples. The system processes data on samples generated by a routine timetable from known sources. It utilizes a desk-top computer and line printer for which a 5 digit coding system was developed. Programs for all calculations of results for regular chemical determinations of water quality were constructed. In addition, utility programs were developed to edit stored data and to list out samples and their values. Raw data is stored in individual files assembled after analysis. Programs and data files for specified analyses are housed on a single tape and can be output separately. Each program includes instructions to flag gross errors and errors of analytical inaccuracy, and checks against predetermined limits. This system is more versatile than manual methods and increases the rate of throughput of samples. It is limited by the small storage capacity of the tapes. (Titus-FRC)
W81-00575

FRESHWATER USE CUSTOMS ON ROTA: AN EXPLORATORY STUDY.
Guam Univ., Agana. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131476, Price codes: A08 in paper copy, A01 in microfiche. Technical Report No 17, 1980. R. A. Stephenson and D. Moore, Editors, 141 p, 37 Photo, 10 Fig, 86 Ref, 2 Append. OWRT A-009-GUAM(2), 14-34-0001-8012, 9012.

Descriptors: *Freshwater, *Water supply, *History, Available water, Water utilization, Behavior, Social values, Social aspects, Guam, *Rota, *Mariana Islands, Micronesia.

Seventy-one Rotanese informants recounted in detail their customs, practices and beliefs concerning freshwater uses before and during World War II to the research team. An archaeological survey was also conducted to suggest possible locations of freshwater sources on Rota in prehistoric and historic times. Research on the ethnohistory of Rota serves to link the past to the present. The results of the research suggest that consistency is shown on Rota from the past to the present in regard to the value of freshwater. Before and during the war, local people were resourceful in building catchments, wells, and the like in order to insure sufficient supplies of freshwater. In the present, Rotanese people express confidence that they will continue to have sufficient supplies of freshwater to meet their daily needs.
W81-00640

STRUCTURE CONTOUR MAP OF THE MADISON GROUP, HAVRE 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
R. D. Feltis.
Available from Montana Bureau of Mines and Geology, Butte, MT. Price $2.50. Montana Bureau of Mines and Geology Geologic Map 9, 1980. 1 Sheet, 2 Ref.

Descriptors: *Maps, *Hydrogeology, *Geohydrologic units, *Aquifers, *Montana, Structural geology, Faults(Geologic), Carbonate rocks, Subsurface mapping, *Madison Group, *Havre quadrangle, Bearpaw Mountains arch, Little Rocky Mountains, Hogeland basin, *Water-bearing formations.

The configuration of the top of the Madison Group, of Mississippian age, is shown by contours on a base map at a scale 1:250,000. The map is one of a series of maps produced as part of a regional study of the geohydrology of the Madison Group in north-central Montana. Contour intervals are 100 and 500 feet. The configuration map shows the approximately 50-mile-long west-trending Bearpaw Mountain arch (Bearpaw Mountains), with the Hogeland basin to the north along the international boundary. The steep dips along the north edge of the Little Rocky Mountains show the effect of a massive laccolith that uplifted and tilted sedimentary rocks. Detailed structural geology is not shown, but a stippled pattern shows where complex folding and faulting of the rocks probably have occurred. (USGS)
W81-00652

STRUCTURE CONTOUR MAP OF THE TOP OF THE MADISON GROUP, GREAT FALLS 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
R. D. Feltis.
Available from Montana Bureau of Mines and Geology, Butte, MT. Price $2.50. Montana Bureau of Mines and Geology Geologic Map 10, 1980. 1 Sheet, 3 Ref.

Descriptors: *Maps, *Hydrogeology, *Geohydrologic units, *Aquifers, *Montana, Structural geology, Faults(Geologic), Carbonate rocks, Subsurface mapping, *Madison Group, *Great Falls quadrangle, Sweetgrass arch, Little Belt mountains, Highwood mountains, Disturbed belt, *Water-bearing formations.

The configuration of the top of the Madison Group, of Mississippian age, is shown by contours on a base map at a scale of 1:250,000. The map is one of a series of maps produced as part of a regional study of the geohydrology of the Madison Group in north-central Montana. Contour intervals are 100 and 500 feet. The configuration map shows mostly a moderate dip northeast from the South arch part of the Sweetgrass arch and from the north flank of the Little Belt Mountains. Southwest of the south arch the dip is steeper into the area of the disturbed belt. At the northeast side of the Little Belt Mountains the dip is into the Judith Basin (east of map area). In the Highwood Mountains area, where igneous instrusions of Tertiary age occur, the Madison Group has not been uplifted enough to be exposed at the surface, and the contour alignment is only slightly more erratic than in surrounding areas. Detailed structural geology is not shown, but a stippled pattern shows areas where complex folding and faulting of the rocks probably have occurred. (USGS)
W81-00653

STRUCTURE CONTOUR MAP OF THE TOP OF THE MADISON GROUP, SHELBY 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
R. D. Feltis.
Available from Montana Bureau of Mines and Geology, Butte, MT. Price $2.50. Montana Bureau of

Mines and Geology Geologic Map 11, 1980. 1 Sheet.

Descriptors: *Maps, *Hydrogeology, *Geohydrologic units, *Aquifers, *Montana, Structural geology, Faults(Geologic), Carbonate rocks, Subsurface mapping, *Madison Group, *Shelby quadrangle, Sweetgrass hills, Kevin-Sunburst dome, Scapegoat-Bannatyne trend, *Water-bearing formations.

The configuration of the top of the Madison Group, of Mississippian age, is shown by contours on a base map at a scale of 1:250,000. The map is one of a series of maps produced as part of a regional study of the geohydrology of the Madison Group in north-central Montana. Contour intervals are 100 and 500 feet. The configuration map shows mostly the northeast regional dip from the Sweetgrass arch (southwest of map area). The map also shows most of the Kevin-Sunburst dome. The steeply dipping structure around the laccoliths that formed the Sweet Grass Hills along the international boundary is in marked contrast to the more gentle dips across the rest of the map. Detailed structural geology is not shown, but a stippled pattern shows areas where complex folding and faulting of the rocks probably have occurred. (USGS)
W81-00654

STRUCTURE CONTOUR MAP OF THE TOP OF THE MADISON GROUP, LEWISTOWN 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
R. D. Feltis.
Available from Montana Bureau of Mines and Geology, Butte, MT. Price $2.50. Montana Bureau of Mines and Geology Geologic Map 12, 1980. 1 Sheet, 4 Ref.

Descriptors: *Maps, *Hydrogeology, *Geohydrologic units, *Aquifers, *Montana, Structural geology, Faults(Geologic), Carbonate rocks, Subsurface mapping, *Madison Group, *Lewistown quadrangle, Little Rocky Mountains, North Moccasin Mountains, South Moccasin Mountains, Judith Mountains, Cat Creek anticline, Blood Creek syncline, Big Snowy anticlinorium, Judith Basin, *Water-bearing formations.

The configuration of the tip of the Madison Group, of Mississippian age, is shown by contours on a base map at a scale of 1:250,000. The map is one of a series of maps produced as part of a regional study of the geohydrology of the Madison Group in north-central Montana. Contour intervals are 100, 500, and 1,000 feet. The configuration map shows the location of the Blood Creek syncline, a broad, rather shallow, east-plunging structural depression bordered on the northeast by the Little Rocky Mountains and on the south by the Judith Mountains and Cat Creek anticline of the Big Snowy anticlinorium. The steeply dipping structure around the several mountains shows the effect of massive laccolithic intrusions of Tertiary age that uplifted and tilted the sedimentary rocks. A major fault extends along the steep northeast flank of the Cat Creek anticline. West of the North and South Moccasin Mountains, the Judith Basin is shown as a major south-trending reentrant from the Madison Group, which regionally dips northeast. Detailed structural geology is not shown, but a stippled pattern shows where complex folding and faulting of the rocks probably have occurred. (USGS)
W81-00655

WATER RESOURCES DATA FOR MASSACHUSETTS AND RHODE ISLAND, WATER YEAR 1979.
Geological Survey, Boston, MA. Water Resources Div.
Geological Survey Water-Data Report MA-RI-79-1, September, 1980. 349 p, 5 Fig.

Descriptors: *Massachusetts, *Rhode Island, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water-resources data for the 1979 water year for Massachusetts and Rhode Island consist of records of stage, discharge, and water quality of streams; contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 102 gaging stations, monthend contents for 30 lakes and reservoirs, water quality for 26 gaging stations, and water levels for 108 observation wells. Also included are data for 19 low-flow and 20 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. A few pertinent stations (not included above) in bordering States are also included in this report. These data represent that portion of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Massachusetts and Rhode Island. (USGS)
W81-00656

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1979--VOLUME 1. MISSOURI RIVER BASIN, AKANSAS RIVER BASIN, AND RIO GRANDE BASIN.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124992, Price codes: A22 in paper copy, A01 in microfiche. Geological Survey Water-Data Report C0-79-1, August 1980. 499 p, 4 Fig, 4 Tab.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Missouri River basin(CO), *Arkansas River basin(CO), *Rio Grande basin(CO).

Water-resources data for Colorado for the 1979 water year consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (volumes 1, 2, and 3) contains discharge records for about 460 gaging stations, stage and contents of 22 lakes and reservoirs, 4 patial-record low-flow stations, 93 crest-stage partial-record stations, and 200 miscellaneous sites; water quality for 143 gaging stations and 130 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are also included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (USGS)
W81-00669

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1979--VOLUME 2. COLORADO RIVER BASIN ABOVE DOLORES RIVER.
Geological Survey, Lakewood, CO. Water Resources Div.
Geological Survey Water-Data Report C0-79-2, July, 1980. 397 p, 4 Fig, 4 Tab, 41 Ref.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Colorado River basin(CO).

Water-resources data for Colorado for the 1979 water year consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (volumes 1, 2, and 3) contains discharge records for about 460 gaging stations, stage and contents of 22 lakes and reservoirs, 4 partial-record low-flow stations, 93 crest-stage partial-record stations, and 200 miscellaneous sites; water quality for 143 gaging stations and 130 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are also included in this report. The records were collected and computed by the Water Resources Divsion of the U.S. Geological Survey. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (USGS)
W81-00670

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1979--VOLUME 3. DOLORES RIVER BASIN, GREEN RIVER BASIN, AND SAN JUAN RIVER BASIN.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-217979, Price codes: A20 in paper copy, A01 in microfiche. Geological Survey Water-Data Report C0-79-3, April 1980. 438 p, 4 Fig, 4 Tab, 40 Ref.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Dolores River basin(CO), *Green River basin(CO), *San Juan River basin(CO).

Water-resources data for Colorado for the 1979 water year consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (volumes 1, 2, and 3) contains discharge records for about 460 gaging stations, stage and contents of 22 lakes and reservoirs, 4 partial-record low-flow stations, 93 crest-stage partial-record stations, and 200 miscellaneous sites; water quality for 143 gaging stations and 130 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are also included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (USGS)
W81-00671

8. ENGINEERING WORKS

8A. Structures

SCREENS FOR WATER INTAKES,
Beaudry (E.) and Cie, Paris (France). (Assignee).
P. Jackson.
U.S. Patent No 4,192,749, 7 p, 3 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 629, March 11, 1980.

Descriptors: *Patents, *Intakes, *Filters, *Aquatic animals, Preservation, Powerplants, Channels, Intakes structures.

A screen for a water intake has a moveable filter element and a recuperation channel adjacent the filter element arranged below the lowest water level. The concavity of the recuperation channel faces the filter element. Suction is applied at the recuperation channel to cause an opposite circulation of water through the filter element at this point. The recuperation channel acts as a safeguarding device for living elements in the water and the opposite circulation of water at the channel detaches living elements from the filter element without traumatism and urges them into the channel. The channel is provided with a filter spaced from the filter element for preventing living elements being entrained by the filter element and carried to the air. (Sinha - OEIS)
W81-00520

HYDRAULIC LABORATORY TECHNIQUES.
Water and Power Resources Service, Denver, CO. Available from Supt. of Documents, GPO, Washington, DC 20402. A Water Resources Technical Publication, 1980. 228 p, 83 Fig, 3 Tab, 50 Ref.

Descriptors: *Hydraulic models, *Laboratory tests, *Hydraulic engineering, Fluid mechanics, Hydraulic similitude, Spillways, Settling basins, Outlet works, Canals, Rivers, Hydraulic structures, Closed conduit flow, Pumps, Hydraulic turbines, Open channels, Free surfaces.

A guide to applying engineering knowledge to hydraulic studies is presented, based on 50 years of research and testing experience at the Bureau of Reclamation, now renamed the Water and Power Resources Service. Emphasis is placed on basic principles of similitude; techniques of model design, construction, and operation; equipment; and field studies. Individual chapters cover: laboratory equipment; instrumentation; model design; laboratory studies; free-surface flow, spillways, stilling basins, and outlet works; canal structures and river channels; problems of free-surface flow; closed-conduit flow; control of flow; pumps, turbines, and energy absorbers; and field studies. (Moore - SRC)
W81-00566

EXPERIENCE IN OPERATING THE DEEP-SHAFT ACTIVATED SLUDGE PROCESS,
Anglian Water Authority, Huntingdon (England). Essex Sewage Div.
For primary bibliographic entry see Field 5D.
W81-00583

NEW FACILITIES INCREASE CAPACITY, IMPROVE EFFICIENCY,
Louisville Water Co., KY.
F. C. Campbell, and K. W. Cosens.
Journal of the American Water Works Association, Vol 72, No 10, p 558-563, October, 1980. 7 Fig.

Descriptors: *Municipal water, *Treatment facilities, *Construction, Intakes, Conduits, Pumping plants, Costs, Control systems, Remote control, Water treatment, Design, Construction costs.

A study of the water needs for Louisville, Kentucky in 1967 indicated that the building of a second raw water intake and treatment facility would be a better step than continued enlargement of the existing facility. As a consulting engineering firm recommended, the raw water intake and pump station were built to accommodate a 120-mgd flow with no stress, providing space for future pumping capacity up to 200 mgd. The river intake, intake conduits, and raw water pumping station cost $9,939,000. Descriptions and illustrations are given of the intake crib, raw water conduits, and the raw water pump station. Control operations are manually started except for chlorination and screen washing. The control room is situated at the pump station. The plant has been operating for three years with one three-day interruption in service, brought about by the flooding of the mechanical room caused by rupture of a ball valve on the chlorine injection system. The system was redesigned to prevent this problem recurring. The plant should be able to function well beyond the turn of the century before the need for expansion arises. (Baker-FRC)
W81-00594

8E. Rock Mechanics and Geology

STRUCTURE CONTOUR MAP OF THE TOP OF THE MADISON GROUP, LEWISTOWN 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00655

8G. Materials

SEWER GROUTS AND HOW TO USE THEM.
American City and County, Vol 95, No 1, p 39-41, January, 1980. 1 Fig.

Descriptors: *Grouting, *Sewers, *Infiltration, *Inflow, Pipes, Leakage, Waste water treatment, Treatment facilities, Chemical grouting, Sealants, Safety, Toxicity, Costs, Repairing, Maintenance.

Internal sealing of leaky joints and pipe fractures to prevent infiltration and inflow of unplanned non-sewage flow into sewers may best be achieved through chemical grouts. Grouting of sewer joints has been done in this country for the past 20 yrs. Use of grouting compounds has reduced the cost of sewer repair and maintenance. The two types of sewer grout available, the acrylamide form and an elastomeric urethane prepolymer, are both toxic in their uncured state. When correctly used, both are virtually non-toxic in their cured form. Precuautionary measures to be followed in handling the acrylamide form include the wearing of protective clothing to avoid eye and skin contact and inhalation and the storing of grout in a protected location. Elastomeric grout is flammable, is a mild skin and eye irritant, and should not be inhaled. An insert on the hazards of acrylamide is included. The application of each type is discussed. While the cost per unit is similar for each grout, it has been noted that smaller amounts of the eleastomeric material are needed. A Montgomery County, Ohio sewer rehabilitation project quoted a cost of $5.79/joint sealed with acrylamide grout. Manufacturers of elastomeric grout quote the grouting of an eight-inch joint with the urethane foam at just over $4.00 and claim that acrylamide costs double the Montgomery County price. No grout available today can be used on house laterals. (Baker-FRC)
W81-00728

8I. Fisheries Engineering

ENTRAINMENT OF ICHTHYOPLANKTON BY IRRIGATION WITHDRAWAL SYSTEMS,
Fish and Wildlife Service, Vancouver, WA.
W. R. Nelson, and L. G. Beckman.
Report FWS/OBS-79/16, 1980. 44 p, 5 Fig, 7 Tab, 22 Ref, 2 Append.

Descriptors: *Irrigation engineering, *Reservoirs, *Plankton, *Fry, *Fish eggs, Missouri River, Fish conservation, Entrainment, Intakes, Fish reproduction, Irrigation permits, Bays, Seasonal, Depth, Flow rates.

The use of Missouri River reservoir water for irrigation was generally neglected until the drought of the mid-1970's. Many of the irrigation intakes were installed in shallow areas of embayments where the potential for entraining ichthyoplankton was substantial. This study was designed to: determine the potential for entraining ichthyoplankton by synthesizing the location and number of irrigation structures with knowledge of the reproductive characteristics of Missouri River fishes; develop methodology to sample irrigation pump effluents and determine the extent of ichthyoplankton entrainment; and, evaluate and update the present guidlines for intake system permits. Pumps were operated in Swan Creek embayment to determine the effect of location and depth of intake on entrainment. One system was operated at a shallow site in the upper reaches of the embayment with the intake about 1.5m deep and the other located at a deep site near the embayment mouth with the intake about 5.1 deep. Each pump was operated at flows of 3.4 cu m/min and 5.5 cu m/min weekly during May and June and biweekly during July and August. About 12 times more larval fish and 840 times more fish eggs were entrained at the shallow site than at the deep site. Entrainment of larvel fish was greatest during May and June and decreased to low levels in July and August. Recommendations are made on how entrainment of ichthyoplankton by irrigation systems can be minimized. (Moore - SRC)
W81-00560

OXYGEN TRANSPORT IN SALMON SPAWNING MEDIA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
R. A. Johnson, and R. F. Carlson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142119, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report No 77-7, September, 1980. 9 p, 3 Fig, 1 Tab, 8 Ref. OWRT-B-039-ALAS(2), 14-34-0001-8057.

Descriptors: *Fish eggs, *Fish hatcheries, Fish populations, *Salmon, *Spawning, Fish, Aquatic animals, Aquatic life, Commercial fish, Marine fish, Marine animals, Fish handling facilities, Fish management, Fish reproduction, Research and Development, *Oxygen demand, Oxygen requirements, Design, Engineering, Life cycles.

Transport of sufficient oxygen to the salmon egg capsule to sustain its metabolic growth is critical to fish egg survival. In this study, measurements were confined to collecting data relating to interstitial flows, which related to both hydraulic head loss and dispersive effects in media comprised of either plastic saddles or gravel. Pressure loss data provided a basis for testing the accuracy of the Ergun equation, needed as part of the oxygen-transport predictive model. It was concluded that the Ergun equation could be used to correlate head loss with apparent velocity. A key conclusion was that head loss for the saddles was much less than for the gravels at a given flow rate. That dispersion coefficients for the river gravels were about three-fold greater than for plastic saddles at a given approach velocity, indicated the former have higher mixing efficiencies. Mixing efficiency appeared to peak at intermediate flow velocities for the river gravel, suggesting an optimal regime for mixing. The observations can be used in hatchery design to assist decision for the use of gravels or saddles as incubation media, and for proper flow velocities. (Zielinski-IPA)
W81-00676

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

GUIDE TO THE NATIONAL POWER PLANT TEAM'S BIBLIOGRAPHIC DATA BASE,
National Power Plant Team, Ann Arbor, MI.
H. A. Handwerger, and K. A. Gilden.
Report FWS/OBS-80/06, March 1980. 50 p, 2 Append.

Descriptors: *Data collections, *Electric powerplants, *Environmental effects, Libraries, Water resources, Indexing, Wildlife, Construction, Data storage and retrieval.

Today the need for an ever-increasing supply of energy is coupled wih a concern for the protection of the environment and it is imperative that decision-makers and concerned citizens be aware of the costs and benefits of electric power generation. The National Power Plant Team (NPPT) has a library and a bibliographic data base which provide current information on these issues. This guide to the data base facilitates the transfer of information to those who need it, and describes the procedures for accessing the NPPT computerized library. A list of terms used in subject indexing is provided. Subjects covered by the data base include: power plants in general, their effect on the environment, construction and operation, advanced fuels and materials, and power resources. The library has in excess of 1,000 volumes dealing with the impacts of steam electric power plants on aquatic resources. (Moore - SRC)
W81-00561

10C. Secondary Publication And Distribution

A BIBLIOGRAPHY OF STREAM ALTERATION (CHANNELIZATION),

Clemson Univ., SC. Dept. of Entomology and Economic Zoology.
T. R. White, and R. C. Fox.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131120, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Clemson University, Technical Report No 87, Volume II, May, 1980. 57 p, 836 Ref. OWRT-A-037-SC(1), 14-34-0001-9043, 14-34-0001-8043.

Descriptors: *Bibliographies, *Reviews, *Streamflow, *Alteration of flow, Channel flow, Aquatic environment, Stream stabilization, Documentation, Information retrieval, Channel improvement, Streams, Publications, Research and Development, Streamflow forecasting, Routing, Flow, Stream improvement, Channel erosion, Channel morphology, Distribution patterns, Channelization.

The detrimental effects of stream channelization were increasingly realized by environmentalists and the general public in the past two decades. Evaluation of these effects with respect to all flora and fauna is required to determine how best to preserve our streams and maintain them as important food chain producers. Research results on stream alteration have been most commonly published as government or other public agency reports, which has made papers difficult to find and has led to uncertainty concerning the actual research accomplished on stream alteration. This bibliography, covering over 800 references, was developed to address this research information need. The citations are arranged alphabetically by author, and not grouped by physical or geographical classifications. (Zielinski-IPA)
W81-00546

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 14, NUMBERS 5 & 6
MARCH 15, 1981

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SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

VOLUME 14, NUMBERS 5 & 6
MARCH 15, 1981

W81-00751 -- W81-01000

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Office of Water Research and Technology. The cumlative SWRA file from 1968 and montlhy updates are available also in magnetic tape through lease from NTIS.

THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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01 NATURE OF WATER

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Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

STUDIES DIRECTED TOWARD COUPLING AN ENERGY BALANCE SNOWMELT MODEL TO A STREAMFLOW RUNOFF MODEL,
California Univ., Santa Barbara. Computer Systems Lab.
J. Dozier, R. Davis, M. Frampton, J. Frew, and B. Marks.
1980 Final Technical Report for University of California Water Resources Center, Davis, California. Grant W-546. 173 p, 35 Fig, 12 Tab, 162 Ref.

Descriptors: *Snowmelt, *Runoff, *Streamflow, Model studies, Snowpacks, Snow cover, Micrometeorological instrumentation, Alpine regions, Snow hydrology, *Energy budget, Mathematical modelling, Remote sensing, Solar radiation, California, Alpine climatology, Watersheds, Stream forecasts, Satellite radiometry, Albedo, Irradiance.

Snowmelt models using the energy balance approach do not rely on statistical relationships and can thus provide reliable data on melt rates even during extremes such as drought or flood. If properly coupled to a streamflow model, an energy balance snowmelt model driven by calibrated satellite data can improve the short-term prediction of spring runoff during extreme snow years. Six papers describe: (1) A clear-sky spectral solar radiation model calculating incident, net, or reflected solar radiation at any point on a snow surface in mountainous terrain if point albedos are known; (2) Measurement of vegetation densities and analysis of the effect of varying canopy densities on irradiance received at the surface contributing to an accurate model of radiation exchange at the snow surface over a large alpine area; (3) Thermal satellite data used to develop an areal simulation of the surface energy budget of an alpine snowcover; (4) Digital terrain information and numerical atmospheric models combined with spaceborne radiance measurements to compute a surface albedo for any given terrain location; (5) A micro-meteorological station in the southern Sierra Nevada contributing to the testing and development of an energy balance snowmelt model by providing undisturbed measurements of energy exchange components, snow mass balance, and snow and soil properties; (6) Measurements of the heat and mass transfer across air-snow and soil-snow interfaces to compute the melt rates and magnitudes from a snowpack. (Mantius-Omniplan)
W81-00755

HIGH WATER LEVELS IN GROUND-WATER DOMINANT LAKES--A CASE STUDY FROM NORTHWESTERN WISCONSIN,
Residuals Management Technology, Inc., Madison, WI.
M. B. Rinaldo-Lee, and M. P. Anderson.
Ground Water, Vol 18, No 4, p 334-339, July-August, 1980. 5 Fig, 1 Tab, 14 Ref. OWRT A-075-WIS(3).

Descriptors: *Wisconsin, *Surface-groundwater relationships, *Water level fluctuations, *Lakes, *Groundwater, Aquifers, Water table, On-site data collections, Computer models, Model studies, Precipitation(Atmospheric), Groundwater movement, Piezometers, Reservoirs, Flow nets, Potentiometric level, Observation wells, Groundwater recharge.

An investigation into the cause of high lake levels during the early 1970s in a groundwater dominant lake in northwestern Wisconsin was conducted from December 1976 to July 1978, in part to address allegations by shoreline property owners that regulation of water levels in a reservoir 2.4 km south of the lake had caused the high lake levels. High lake levels also coincided with above average precipitation. Data collected during the study allowed the definition of the groundwater flow system around the lake and the calculation of the water budget for the lake. Field data indicated that there is no groundwater flow between the reservoir and the lake and that groundwater flowing out of the reservoir is intercepted by a trough in the potentiometric surface. The trough is probably oriented along a permeable fault zone or a buried river valley. A groundwater flow model was used to determine whether increased recharge rates of the magnitude that probably occurred as a result of above average precipitation in the early 1970s would be sufficient to account for the observed rise in lake level or whether regulation of the water level in the reservoir could be expected to affect lake level. (Visocky-ISWS)
W81-00810

2B. Precipitation

PRACTICAL CONSIDERATIONS IN THE APPLICATION OF SURFACE FITTING TECHNIQUES FOR ESTIMATIONS OF AREAL RAINFALL,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Agricultural Engineering.
R. E. Schulze.
In: Preprint Volume, Tenth Conference on Severe Local Storms, October 18-21, 1977, Omaha, Nebraska, p 104-109, 1977. 5 Fig, 1 Tab, 16 Ref. American Meteorological Society, Boston, Massachusetts.

Descriptors: *Mathematical studies, *Rainfall, *Distribution patterns, *Estimating, *Water resources, Least squares method, Evaluation, Rain gages, Simulated rainfall, Precipitation(Atmospheric), Sampling, Gaging stations, Geomorphology, Drainage density, Hydrogeology, Runoff, Watersheds(Basins), Topography, Altitude, Planning, Maps, Mountains, Forecasting, South Africa.

Trend surface analysis of point and areal rainfall in the mountainous Drakensburg area, South Africa, was evaluated for accuracy and used to estimate water resources in the region. The technique is essentially an application of the least squares theory and the physiographic factors such as altitude yield and the adequacy of the rainage network in the area must be included in the analysis for meaningful results. These 4-dimensional hypersurfaces give more realistic rainfall patterns than 3-dimensional surfaces. More improvement in the rainfall maps can be made if the longitudinal and latitudinal grid is aligned with major trends. A comparison of rainfall surfaces and residuals of a small catchment at Cathedral Peak with the Drakensberg area indicated rainfall anomalies associated with local topography. The presence or absence of key stations, especially in peripheral and isolated high altitude stations, can significantly alter rainfall estimations. Supression of variables in order to normalize them in respect to other variables does not improve the analysis. High order polynomials should not be used if the gaging network is incomplete, otherwise erroneous results are obtained. Trend surface analysis of physiographic-dependent rainfall data is an extremely useful tool for water resource planning if coupled with an adequate rainage network. (Sidney-IPA)
W81-00773

2C. Snow, Ice, and Frost

PENETRATION OF SOLAR RADIATION IN SNOW-ICE COVERED WATER RESERVOIRS: WINTERKILL,
Missouri Water Resources Research Center, Rolla.
For primary bibliographic entry see Field 2H.
W81-00979

2E. Streamflow and Runoff

RIPARIAN HABITAT AND INSTREAM FLOW STUDIES, LOWER VERDE RIVER: FORT MCDOWELL RESERVATION, ARIZONA,
Fish and Wildlife Service, Albuquerque, NM.
R. M. McNatt, R. J. Hallock, and A. W. Anderson.
Report, June, 1980. 58 p, 16 Fig, 8 Tab, 50 Ref, 1 Append.

Descriptors: *Streamflow, *Fish populations, *Riparian plants, *Cottonwoods, Arizona, Wildlife, Dams, Groundwater resources, Flow control, Aquatic habitats, Rainbow trout, Carp, Channel catfish, Sunfishes, Bass, Brown trout, Suckers, Minnows, Habitat improvement, Verde River.

The Fort McDowell reach of the Verde River in Arizona contains high quality riparian habitat which supports a wide variety of fish and wildlife species, and riparian vegetation. The riparian zone has value for recreation, flood control, groundwater recharge, bank stabilization, erosion control, honey production, livestock grazing, and fuel wood production. Weighted Usable Area (WUA) curves are provided for selected fishes (rainbow trout, carp, channel catfish, bluegill, green sunfish, largemouth bass) that commonly occur in the Fort McDowell Reach. WUA curves are also provided for brown trout, small mouth bass and white sucker (closely related to native suckers). WUA curves for adult rainbow and brown trout show maximum values at stream flows ranging from 200 to 300 cfs; other species, such as channel catfish and native suckers and minnows, would also be enhanced, if flows of this magnitude can be maintained. A high rate of mortality of cottonwood trees coincided with the 1977 drought, when water releases from Bartlet Dam were nearly eliminated. Tree mortality was greatest (60 to 84%) in the stream reach influenced by groundwater withdrawals by the City of Phoenix. It is recommended that a streamflow of at least 200 cfs be maintained along the Fort McDowell reach to maintain and enhance fish and wildlife resources and riparian habitat. (Moore-SRC)
W81-00756

ON THE ELEVEN-YEAR SOLAR CYCLE AND RIVER FLOW,
University of the Witwatersrand, Johannesburg (South Africa).
T. G. J. Dyer.
Water SA (Pretoria), Vol 4, No 4, p 157-160, 1978. 2 Fig, 3 Ref.

Descriptors: *Solar radiation, *River flow, *Dams, *Mathematical studies, *Climatology, *Time series analysis, Correlation anlysis, Africa, Flow, Rivers, Forecasting, Reliability.

Temporal ten-year patterns are shown in a theoretical study covering seven river flows (Zambezi, Okavango, Komati, Pongola, Mooi, Mzimkulu, Steenbras) and in-flows of three dams (Gaberone, Marico-Bosveld, Hartbeespoort), covering the length of South Africa for the intercomparison of flow fluctuations with the solar cycle. No simple relationship was found. In some cases, river flow and solar cycle were in-phase, in other cases they were in anti-phase while in others there were periods of in-phase followed by an abrupt discontinuity leading to anti-phase. It is concluded that an hypothesis of no relationship between river flow and the solar cycle could not be accepted, and further study is recommended. (Zielinski-IPA)
W81-00778

2F. Groundwater

ESSENTIALS OF GROUND-WATER HYDROLOGY PERTINENT TO WATER-RESOURCES PLANNING,
Water Resources Council, Washington, D. C. Hydrology Committee.
Available from Supt. of Documents, GPO, Washington, DC 20402. Bulletin 16 (revised), 1980. 45 p, 6 Fig, 1 Tab, 68 Ref.

Descriptors: *Groundwater resources, *Hydrology, *Planning, Model studies, Water resources, Decision making, Water management(Applied), Aquifers, Surface-groundwater relationships.

With current emphasis on regional and river basin planning for water and related land resources, and increased emphasis on environmental protection and management, it is important that ground water be investigated as a basic element of water supply to determine its availability and utility within local-

ized areas and to consider its broader role in regionwide water resources planning and management. Well-established fundamental principles of groundwater behavior and a fund of descriptive knowledge of the groundwater reservoirs, coupled with recent advances in investigative and analytical methods of groundwater hydrology, provide firm footing for improved planning for management of the resource. Modeling methods constitute powerful tools for prediction of the effects of groundwater withdrawals and for the design of rational programs of management and protection. Incorporating groundwater into water systems management and into broader land and water programs is both feasible and practical. (Moore-SRC)
W81-00759

SURFICIAL GEOLOGY OF RICHLAND QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00813

SURFICIAL GEOLOGY OF PART OF CLEVELAND QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Syracuse Univ., NY.
For primary bibliographic entry see Field 7C.
W81-00814

A COMPARISON OF ANALOG AND DIGITAL MODELING TECHNIQUES FOR SIMULATING THREE-DIMENSIONAL GROUNDWATER FLOW ON LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
T. E. Reilly, and A. W. Harbaugh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226095, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-14, 1980. 40 p, 16 Fig, 2 Tab, 18 Ref.

Descriptors: *Analog models, *Digital computers, *Model studies, *Numerical analysis, Analytical techniques, Groundwater movement, Hydraulic conductivity, Hydrogeology, Aquifer characteristics, Water storage, Water table, Regional analysis, New York, *Long Island(NY), Finite-difference method.

A three-dimensional electric-analog model of the Long Island, NY, groundwater system constructed by the U.S. Geological Survey in the early 1970's was used as the basis for developing a digital, three-dimensional finite-difference model. The digital model was needed to provide faster modifications and more rapid solutions to water-management questions. Results generated by the two models are depicted as potentiometric-surface maps of the upper glacial and Magothy aquifers. Results compare favorably for all parts of Long Island except the northwestern part, where hydrologic discontinuities are most prevalent and which the two models represent somewhat differently. The mathematical and hydrologic principles used in development of ground-water models, and the procedures for calibration and acceptance, are presented in nontechnical terms. (USGS)
W81-00830

THE EFFECT OF DISSOLUTION OF VOLCANIC GLASS ON THE WATER CHEMISTRY IN A TUFFACEOUS AQUIFER, RAINIER MESA, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2K.
W81-00831

GROUND-WATER CONDITIONS AT BEALE AIR FORCE BASE AND VICINITY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-00832

SURFICIAL GEOLOGY OF TEXAS QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Syracuse University, NY.
For primary bibliographic entry see Field 7C.
W81-00837

2H. Lakes

THE CHEMICAL AND BIOLOGICAL EFFECTS OF ANNUAL DIEBACK OF MYRIOPHYLLUM SPICATUM L. AND THE IMPORTANCE RELATIVE TO NUTRIENT CYCLING IN MONROE RESERVOIR, MONROE CO., INDIANA,
Indiana Univ. at Bloomington. Dept. of Biology.
D. H. Landers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142986, Price codes: A07 in paper copy, A01 in microfiche. Doctor of Philosophy Thesis, 1979. 129 p, 20 Fig, 15 Tab, 70 Ref, 1 Append. OWRT-B-099-IND(2).

Descriptors: *Myriophyllum spicatum, *Nitrogen, *Phosphorus, *Cycling nutrients, *Senescence, Lakes, Standing crops, Environmental effects, Nutrients, Phytoplankton, Chlorophyll, Aerial photography, Evaluation, *Monroe Reservoir(IN).

Enclosures (2-m diameter) were placed in the littoral zone of Monroe Reservoir, Monroe Co., Indiana, to evaluate the chemical and biological effects of late summer dieback of Myriophyllum spicatum. Aerial photography, combined with quadrat sampling, was used to measure the standing crop at peak summer biomass. Plant tissue analysis was applied to total biomass estimates to determine potential N and P release from senescing macrophytes. At the time of dieback, considerable pulses of SRP, HN3-N and N03-N were detected in the enclosures containing plants and in the adjacent open-water sites. These nutrient inputs were associated with episodes of normal macrophyte senescence and decay. Chlorophyll a increased greatly in response to these nutrient inputs, indicating important increases in phytoplankton production as a direct consequence of macrophyte dieback. Crashing autumn phytoplankton populations were responsible for additional pulsed inputs of SRP, NH3-N and N03-N in enclosed and open-water locations. Realized nutrient inputs from senescent M. spicatum are estimated to represent as much as 20% of the annual P. budget, and not more than 2.2% of the annual N. budget for the reservoir.
W81-00752

HIGH WATER LEVELS IN GROUND-WATER DOMINANT LAKES--A CASE STUDY FROM NORTHWESTERN WISCONSIN,
Residuals Management Technology, Inc., Madison, WI.
For primary bibliographic entry see Field 2A.
W81-00810

PENETRATION OF SOLAR RADIATION IN SNOW-ICE COVERED WATER RESERVOIRS: WINTERKILL,
Missouri Water Resources Research Center, Rolla.
A. L. Crosbie, and W. Davidson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-149643, Price codes: A06 in paper copy, A01 in microfiche. Completion Report, November 28, 1980. 118 p, 14 Fig, 17 Ref, 2 Append. OWRT-A-113-MO(1), 14-34-0001-9027 & 0127.

Descriptors: *Model studies, *Winterkilling, *Aquatic life, Forecasting, *Iced lakes, *Solar radiation, Ice cover, Reservoirs, Light penetration, Light intensity, Reflectance, Optical properties, Albedo, Snow cover.

A snow-ice covered water reservoir is modeled by two absorbing-scattering planar layers. The scattering centers in the snow layer are assumed to be ice spheres, while the scattering centers in the ice layer are assumed to be spherical voids. The scattering characteristics of each layer are predicted by Mie theory. A Dirac-delta function approximation to the scattering phase function is introduced to simplify the analysis and account for strong forward scattering due to diffraction. An invariant imbedding solution technique is then used to solve the transport equation including multiple scattering for the penetration of solar radiation through the snow-ice layer. Both collimated and diffuse solar radiation are considered. The results show good agreement between the isotropic and anisotropic approximations except at large incident angles and small depths. The penetration of solar radiation is strongly dependent on the asymmetry factor, single scattering albedo and optical thickness of the snow layer. Simplified expressions valid for large optical depths are presented. The reflection of solar radiation is also predicted. The results of this investigation should help predict winterkill (the suffocation of aquatic animal life in the winter months).
W81-00979

2I. Water In Plants

IMPACT OF WATER LEVEL CHANGES ON WOODY RIPARIAN AND WETLAND COMMUNITIES, VOLUME VII, MEDITERRANEAN REGION , WESTERN ARID AND SEMI-ARID REGION,
Missouri Univ., Columbia. School of Forestry, Fisheries and Wildlife.
M. A. Walters, R. O. Teskey, and T. M. Hinckley.
Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-78/93, July 1980. 90 p, 19 Fig, 6 Tab, 47 Ref. USDI 92365-0110.

Descriptors: *Riparian plants, *Water level fluctuations, *Arid lands, Semiarid climates, Wetlands, Trees, Shrubs, Floods, Droughts, Seasonal, Arizona, New Mexico, California, Utah, Nevada, Idaho, Washington, Oregon, Groundwater.

This literature review synthesizes existing information on the effect of water level changes on woody plants found in riparian and wetland communities in the Mediterranean, Western Arid and Semi-arid Regions. These regions cover Arizona, New Mexico, California, Utah, Nevada, southern Idaho, eastern Washington and Oregon. In addition, the effect of drought on woody plants of these regions is described. Riparian vegetation is normally exposed to high groundwater levels as well as to periods of excess water due to flooding. The effect of excess water often causes stress to the plant resulting in decreased growth or even death. A plant's response to flooded conditions depends on many factors, including the species tolerance, water level, duration of flooding and time of year. Available information for individual species of the region is listed in a tabular format. (Moore-SRC)
W81-00765

INPUT AND EARLY DIAGENESIS OF CHLOROPHYLLS IN A TEMPERATE INTERTIDAL SEDIMENT,
Melbourne Univ., Parkville (Australia), Dept. of Organic Chemistry.
F. T. Gillan, and R. B. Johns.
Marine Chemistry, Vol 9, No 4, p 243-253, August, 1980. 2 Fig, 4 Tab, 19 Ref.

Descriptors: *Chlorophyll, *Diagenesis, *Intertidal areas, *Sediments, Coasts, Temperate, Australia, Diatoms, Degradation(Decomposition), Stability, Sampling, Algae, Cores.

The initial steps of chlorophyll-a decomposition in temperate sandy intertidal sediment samples from a low-energy coastline of Corner Inlet, SE Victoria were examined. Diatom input into the surface layers was noted as the major source of chlorophyll-a. In the study area, relative stabilities were chlorophyll-a > chlorophyllide-C2 > chlorophyllide-C1. Chlorophyll-b was present only in trace quantities and was observed to be stable down to 10 mm in depth. In the upper sedimentary layers, bacteriochlorophyll-a and bacteriopheophytin-a levels were found to be stable throughout the

depth profile and inversely proportional to one another. Depth profile results on chlorophyll-a derivatives including pheophytin-a gave no evidence that these compounds were intermediates of chlorophyll-a degradation in the environment examined. With greater depth, further degradation of chlorophyll-a to colorless products occurred, presumably in intact algal cells. (Geiger-FRC)
W81-00951

2K. Chemical Processes

THE EFFECT OF DISSOLUTION OF VOLCANIC GLASS ON THE WATER CHEMISTRY IN A TUFFACEOUS AQUIFER, RAINIER MESA, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
A. F. White, H. C. Claassen, and L. V. Benson.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.25. Geological Survey Water-Supply Paper 1535-Q, 1980. 34 p, 11 Fig, 5 Tab, 36 Ref.

Descriptors: *Water chemistry, *Geochemistry, Hydrogeology, Aquifer characteristics, *Groundwater movement, Chemical reactions, Kinetics, Rhyolites, Zeolites, Ion exchange, Adsorption, Nevada, *Volcanic glass, *Tuffaceous rocks, *Rainier Mesa(NV), Nevada test site.

Geochemistry of ground water associated with the Tertiary tuffs within Rainier Mesa, southern Nevada, was investigated to determine the relative importance of glass dissolution in controlling water chemistry. Water samples were obtained both from interstitial pores in core sections and from free-flowing fractures. Cation compositions showed that calcium and magnesium decreased as a function of depth in the mesa, as sodium increased. The maximum effect occurs within alteration zones containing clinoptilolite and montmorillonite, suggesting these minerals effectively remove bivalent cations from the system. Comparisons are made between compositions of ground waters found within Rainier Mesa that apparently have not reacted with secondary minerals and compositions of waters produced by experimental dissolution of vitric and crystalline tuffs which comprise the principal aquifers in the area. The two tuff phases have the same bulk chemistry but produce aqueous solutions of different chemistry. Rapid parabolic dissolution of sodium and silica from, and the retention of potassium within, the vitric phase verify previous predictions concerning water compositions associated with vitric volcanic rocks. Parabolic dissolution of the crystalline phase results in solutions high in calcium and magnesium and low in silica. Extrapolation of the parabolic dissolution mechanism for the vitric tuff to long times successfully reproduces at comparable pH, cation ratios existing in Rainier Mesa ground water. Comparison of mass-transfer rates of the vitric and crystalline tuffs indicates that the apparent high glass-surface to aqueous-volume ratio associated with interstitial permeability may account for dominance of the glass reaction. (USGS)
W81-00831

QUANTIFYING THE EUTROPHICATION PROCESS: DIFFICULTIES CAUSED, FOR EXAMPLE, BY SEDIMENTS,
H. Golterman.
Progress in Water Technology, Vol 12, No 2, p 63-80, 1980. 5 Fig, 22 Ref.

Descriptors: *Eutrophication, *Lakes, *Rivers, *Limnology, Model studies, Sediments, Aquatic environment, Water chemistry, Water properties, Algal control, Algae.

Even though present day information regarding the processes of eutrophication and their outcome is not complete, initial steps must be taken toward maintaining water quality. Knowledge is presently available to provide practical guidance for policy makers. The limitations of the models presently available are reviewed. The relation between algal biomass or algal growth rate and nutrients may be described using two separate submodels. The first deals with the relation between nutrient input and nutrient concentration. The second deals with the relation between nutrient concentration and algal growth. The adsorption model and the loading plus algal biomass model may also be employed. While each of these models is acceptable for a particular circumstance, a much greater understanding of the background mechanisms must be attained before conceptual models can be generated. (Baker-FRC).
W81-00863

EUTROPHICATION IN RELATION TO THE LOAD OF POLLUTION,
Uppsala Univ. (Sweden). Inst. of Limnology.
T. Ahl.
Progress in Water Technology, Vol 12, No 2, p 49-61, 1980. 10 Fig, 1 Tab, 30 Ref.

Descriptors: *Eutrophication, *Limnology, *Precipitation(Atmospheric), *Nutrients, Oligotrophy, Water properties, Water quality, Lakes, Geomorphology, Soiltypes.

Eutrophication is defined as a process which leads to nutrient-rich conditions in a body of water, regardless of the biological effects of such enrichment. In most cases such an enrichment will lead to increased biological activity. However, in cases of toxic enrichment, the effect will be opposite. Increases in nutrient load can result from precipitation and atmospheric deposition, from the soil, or from sources related to man's activities. The geographic distribution of the wet fallout of total nitrogen is described for 1968-1969 and compared with 1958-1959. While the wet deposition of phosphorus is not as well known, some data are presented. The terrestrial contribution of undisturbed soil to nutrients in a lake is influenced by climate, type of soil, topography, and vegetation. Disturbances of soil can alter the contribution of the area to the nutrients in nearby lakes. Such disturbances would include the use of inorganic fertilizers, cultivation of soil and other activities. Point sources of nutrients to the water come from urban areas and result from discharge of untreated domestic sewage and other activities. The annual discharge of nitrogen from Swedish industry has been estimated at 10,400 tons. If the average N/P ratio in industrial waste water is 7.5, this would yield a phosphorus discharge of 1,500 tons/yr. Studies indicated that the difference between a nutrient load giving oligotrophic conditions and one giving eutrophic conditions is much greater than would be suggested by the total amounts of nutrients involved. (Baker-FRC)
W81-00883

2L. Estuaries

TRENDS IN COASTAL WASTE TREATMENT,
WAPORA, Inc., Chevy Chase, MD.
For primary bibliographic entry see Field 5D.
W81-00891

THE APPLICATION OF AN ECOSYSTEM MODEL TO THE BRISTOL CHANNEL AND SEVERN ESTUARY,
Institute for Marine Environmental Research, Plymouth (England).
P. J. Radford, and I. R. Joint.
Water Pollution Control, Vol 79, No 2, p 244-254, 1980. 8 Fig, 7 Ref.

Descriptors: *Model studies, *Channels, *Estuaries, Aquatic ecosystems, Recycling, Nutrients, Environmental effects, Pollutants, On-site data collections, Monitoring, Data collections, Bristol channel, Severn estuary, England.

The formulation and application of the GEMBASE model, an ecosystem model describing the Bristol Channel and Severn Estuary, are presented. Research in the channel, data from the literature, and laboratory experiments were used to derive the model. The model showed that the riverine input of nutrients was not sufficient to support the observed primary production rate and that local nutrient recycling must occur. Nutrient regeneration studies in the Carmarthen Bay have commenced as a result of model information. GEMBASE will also be utilized to answer applied problems and to predict the consequences of building a tidal barrage on the channel ecosystem. Expansions on the model could be used to evaluate the effects of pollutants on the ecosystem where data on effects already exist. The hydrodynamic subsystem would simulate the distribution of any conservative pollutant and, if the relationship is known between a pollutant's concentration and its biological effect, the effect on the entire ecosystem could be simulated. Data collected from 1977 to 1981 on monitoring cruises in the British Channel will be used to validate the verified version of GEMBASE. (Geiger-FRC)
W81-00907

INPUT AND EARLY DIAGENESIS OF CHLOROPHYLLS IN A TEMPERATE INTERTIDAL SEDIMENT,
Melbourne Univ., Parkville (Australia), Dept. of Organic Chemistry.
For primary bibliographic entry see Field 2I.
W81-00951

EFFECTS OF ALTERED FRESHWATER INFLOW ON ESTUARINE SYSTEMS,
Texas Univ. at Austin. Environmental Health Engineering Lab.
N. E. Armstrong.
In: Proceedings of the Gulf of Mexico Coastal Ecosystems Workshop, September 4-7, 1979, Port Aransas, Texas, Fore, P. L., and Peterson, R. D., Eds., Fish and Wildlife Service, Office of Environment, Report FWS/OBS-80/30, May, 1980, p 17-31. 6 Fig, 9 Ref. 14-16-0002-79-152.

Descriptors: *Estuaries, *Freshwater, *Inflow, *Water quality, Ecology, Flow, *Environmental effects, Salinity, Mathematical models, Productivity, Spatial distribution, Temporal distribution, Biota, Commercial fishing.

There are three critical elements in this framework for determining freshwater release needs for estuarine systems. The first is the determination of appropriate water quality levels needed to sustain the diversity and productivity of the bay system, particularly commercially important species. The second is the process or predictive basis by which the effects of spatial and temporal distributions of freshwater flows are determined. The third is the determination of the quality and scheduling of freshwater inflows. Studies have related inflows to biological changes in estuaries using the community approach, the population approach, and the individual approach. The method chosen for such studies should be a function of the data available for the analysis. By exercising mathematical models for the system being studied, freshwater inflows may be correlated with changes in water quality at any point. Using this information and estimates of freshwater inflows to the bay, the effects of changes in freshwater inflows can be determined. (Moore-SRC)
W81-00992

STUDIES OF FRESHWATER NEEDS OF FISH AND WILDLIFE RESOURCES IN NUECES-CORPUS CHRISTI BAYS, TEXAS,
Fish and Wildlife Service, Austin, TX.
N. A. Funicelli.
In: Proceedings of the Gulf of Mexico Coastal Ecosystems Workshop, September 4-7, 1979, Port Aransas, Texas, Fore, P. L., and Peterson, R. D., Eds., Fish and Wildlife Service, Office of Environment, Report FWS/OBS-80/30, May, 1980, p 97-102. 1 Tab, 4 Ref.

Descriptors: *Estuarine environment, *Inflow, *Freshwater, *Salinity, *Biota, Ecology, Texas, Wildlife, Development stages, Water chemistry, Fish, Nutrients, Water quality, Aquatic plants, Shellfish, Seasonal, Management, Sediments, Productivity, Seagrasses, *Nueces-Corpus Christi Bays(TX).

The proposed Choke Canyon Reservoir could adversely affect the productivity of the Corpus

Christi, Nueces estuarine system by reducing the inflows of fresh water, nutrients, and sediments. Plants were collected and production measured from September 1978 to June 1979 from 10 transects representative of the Nueces delta, Harbor Island and Mustang Barrier Island study areas. Dissolved nutrient parameters were monitored during diurnal sampling. Larval, post-larval, juvenile, and adult fish and shellfish were sampled at various stations in the seagrass beds. Physiochemical data were also collected at all stations. Live standing crop was highest during the late spring, summer, and early fall, and lowest during the winter months. Inorganic nutrient concentrations were typically higher in the Nueces Marsh than in the seagrass beds. Analysis of nutrient exchange data during the period October 1978 to June 1979 indicated that the net annual flow of all nutrients was into Nueces marsh. Analysis of fish data indicated decreased use of marsh habitat during the winter months. Preliminary study indicates that fresh water inflow management cannot be tied to salinity management in Nueces, Corpus Christi Bays. Fresh water inflow must be considered as a transport system for estuarine nutrients and a mechanism for flooding which allows optimum habitat utilization. (Moore-SRC)
W81-00996

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

THE INFLUENCE OF ACCELERATION AND FLOW ON CONCENTRATION POLARIZATION IN REVERSE OSMOSIS,
SRI International, Menlo Park, CA.
G. B. Andeen, and M. S. Colah.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-134926. Final Report to Office of Water Research and Technology, November, 1980. 167 p, 17 Fig, 3 Tab, 16 Ref, 1 Append. OWRT-C-80364-S(No 9462)(1), 14-34-0001-9462.

Descriptors: *Reverse Osmosis, *Boundary layers, *Centrifugation, *Desalination processes, Testing procedures, Mass transfer, Evaluation, Concentration polarization, Acceleration.

'Concentration polarization' is the buildup of enriched brine at the membrane surface during reverse osmosis desalination. The usual techniques for limiting the buildup involve diffusion and flushing. The tests show that acceleration, as in a centrifuge, also can control the concentration polarization. Acceleration forces act preferentially on the enriched, more dense brine, pulling it from the membrane surface. Acceleration can also control flow distribution and reduce fouling. Hollow-fiber reverse osmosis elements were operated in a continuous flow centrifuge up to 1000 g. Increased flow and quality of desalted water indicated reduced concentration polarization under acceleration or increased brine flow. The effective mass transfer coefficient for removal of salt from the membrane surface was changed as much by doubling the acceleration as by doubling the flushing flow. Use of acceleration would allow use of higher transport rate membranes. This, together with fouling reduction, may make use of centrifuges in reverse osmosis economically attractive.
W81-00971

3B. Water Yield Improvement

MASS AND HEAT TRANSFER IN A CIRCULAR TUBE WITH BIOFOULING,
Rice Univ., Houston. Dept. of Chemical Engineering.
J. P. Kirkpatrick, L. V. McIntire, and W. G. Characklis.
Water Research, Vol 14, No 2, p 117-127, February, 1980. 14 Fig, 26 Ref.

Descriptors: *Mass transfer, *Heat transfer, *Fouling, *Mathematical models, Laminar flow, Microorganisms, Heat, Heat flow, Temperature, Heat exchangers, Fluid mechanics, Thermodynamics, Pipelines.

A phenomenological model for development of biofilm in a circular tube is presented, and its effect on heat transfer is examined under conditions of both laminar flow and turbulent flow. With laminar flow, radial mass transfer takes place solely by molecular diffusion, and with turbulent flow it takes place by both molecular and convective diffusion. Determination of heat transfer involves equations analogous to those for mass transfer, except that heat produced in the biofilm is assumed to be negligible and that a fluid is held at a constant temperature outside the tube. The presence of biofilm was found to decrease heat transfer significantly in both laminar and turbulent flow. As the thickness of the film increases in turbulent flow, there is a related change in the bulk concentration profile. For coupled heat and mass transfer, mass diffusivity, viscosity, and reaction rate are strongly temperature dependent. Biofilm thickness varies with fluid temperature. The results of the model are widely applicable in fouling systems. They suggest that for quantitative estimates of coupled heat and mass transfer, computations for particular parameters are necessary. (Titus-FRC)
W81-00789

3C. Use Of Water Of Impaired Quality

INSTITUTIONAL CONSTRAINTS ON ALTERNATIVE WATER FOR ENERGY, A GUIDEBOOK FOR REGIONAL ASSESSMENTS.
For primary bibliographic entry see Field 6E.
W81-00892

A PRELIMINARY SITE EVALUATION METHOD FOR TREATMENT OF MUNICIPAL WASTEWATER BY SPRAY IRRIGATION OF FOREST LAND,
Law Engineering Testing Co., Marietta, GA.
G. L. Taylor.
In: Third Annual Madison Conference of Applied Research & Practice on Municipal & Industrial Waste, September 10-12, 1980, p 22-33, 1980. 4 Tab, 12 Ref. University of Wisconsin-Extension, Department of Engineering & Applied Sciences, 432 N. Lake Street, Madison, WI 53706.

Descriptors: *Land treatment, *Wastewater, *Waste treatment, *Irrigation waste water, *Hydrologic budget evapotranspiration, Percolation, Precipitation, Design criteria, Climactic data, Data collection, Topography.

Specific knowledge of the hydrologic and chemical interactions between soil, climate, topography, and vegetation is necessary to properly design land treatment systems and predict with some certainty the long-range impacts of the system. Land treatment system evaluation can be divided into two major phases: site evaluation and hydrologic budget evaluation, with the former being completed first. Seven primary factors are used to evaluate a site for land treatment and to determine if spray irrigation of wastewater can be utilized at a specific site. Nine secondary factors are also used to evaluate the site but are not as critical as site suitability. The hydrologic budget for a spray irrigation, land treatment site has four components: design precipitation, evapotranspiration, percolation of water to the groundwater, and wastewater hydraulic loading. Wastewater must be applied uniformly at the proper hydraulic loading and application rates for adequate renovation. Proper design and diligent management are critical. Unicoi State Park in southeastern United States was used to develop the design information base. Soil percolate samples have shown that the Park has been adequately renovating municipal wastewater for seven years. (Atkins-Omniplan)
W81-00932

SALINE CULTURE OF CROPS: A GENETIC APPROACH,
California Univ., Davis. Agricultural Experimental Station.
E. Epstein, J. D. Norlyn, D. W. Rush, R. W. Kingsbury, and D. B. Kelley.
Science, Vol 210, No 4468, p 399-404, October, 1980. 3 Fig, 3 Tab, 55 Ref.

Descriptors: *Salinity, *Irrigation practices, *Genetics, *Saline water, *Crop production, Water requirements, Irrigation water, Soil chemical properties, Barley, Wheat, Tomatoes, Osmotic pressure, Available water, Adaptation, Fruit crops, Salts, Sea water, Saline water intrusion.

Countries that depend upon irrigation of crops for agriculture are often faced with the problem of high levels of salts in irrigation and groundwater supplies. High salt levels in soils create high osmotic pressures, making water even less available to plants. Since engineering approaches to the problem of water supply salinity can only manipulate the environment to try to provide adequate irrigation water, often at high expense, it was suggested that a genetic approach involving the development of salt-tolerant plants be used to increase crop yields. Although saline soils exist in subhumid regions, they are most prevalent in arid and semi-arid regions. California suffers from high soil salinity in three agricultural valleys. Work done on salt-tolerant plants at the University of California includes experiments on various barley and wheat genotypes and some tomato cultivars. Preliminary results indicate that species tolerant to salt levels near that of sea water should be attained soon in crops of wheat and barley; however, salt-tolerant tomato plants suffer drastic reductions in fruit size and possess limited value for commercial use. Use of certain rhizobial fungi may enhance the salt tolerance of nitrogen-fixing legumes. Grafting techniques have been studied to increase salt-tolerance levels of woody plants and fruit trees. Research is presently being conducted on the mechanisms of salt tolerance in plants. Further work is needed on international collaboration and wild halophytes. Geographical, economic and social areas where research on saline crop culture would have the most benefits should also be considered. (Geiger-FRC)
W81-00953

RECYCLING OF SEWAGE EFFLUENT BY SUGARCANE IRRIGATION: A DILUTION STUDY, OCTOBER 1976 TO OCTOBER 1978, PHASE II-A,
Hawaii Univ., Honolulu.
S. L. Lau, P. C. Ekern, P. C. S. Loh, R. H. F. Young, and G. L. Dugan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-144669, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Center, University of Hawaii, Honolulu, Technical Report No 130, March, 1980. 3 Fig, 21 Tab, 39 Ref, 6 Append. 14-34-0001-3811.

Descriptors: *Sugarcane, *Sewage effluents, *Water reuse, Furrow irrigation, Viruses, On-site tests, Hawaii, Agriculture, Dilution(Wastes).

An extension of the project, 'Recycling of Sewage Effluent by Irrigation: A Field Study on Oahu.' This portion's objective was to determine the dilution with Waiahole Ditch water necessary for optimal sugar yield when chlorinated, secondarily treated sewage was used for irrigation of cane. Hawaiian sugarcane variety 59-3775 was planted to a random-block design of treatments with 6 replicates in central Oahu near the Mililani Sewage Treatment Plant. The 5 irrigation treatments for the two-cane cycle were: (1) ditch water; (2) 12.5%; (3) 25%; (4) 50% effluent diluted with ditch water; and (5) effluent the first year and ditch water the second. The ripener 'Polaris' was applied prior to harvesting. Crop logs monitored the cane growth and test plots were hand harvested for assessment of cane and sugar yield. Soil water percolate and sewage effluent were chemically analyzed to check for human enteric viruses. Sugar yields for effluent concentrations up 25%, or for effluent the first year and ditch water the second.

were equal to those from conventional ditch-water irrigation. There was a significant loss in juice quality and sugar yield for the 50% effluent concentrations. Immediately after each application of fertilizer and with effluent concentrations of 50 to 100%, the nitrate nitrogen concentrations in the percolate exceeded the critical level of 10 ppm for potable water. Total applications exceeded the sugarcane's ability to take up nitrogen; however, an apparent nitrogen deficit was assigned to gaseous nitrogen loss. No virus was recovered but 40% of the effluent reservoir samples were positive. At least 96% of the virus was inactivated after 1 day of storage. (Author's abstract)
W81-00981

3D. Conservation In Domestic and Municipal Use

DISTRIBUTION PATTERNS OF HOME LAWN SPRINKLERS,
Wyoming Univ., Laramie.
G. L. Kerr, L. O. Pochop, J. Borrelli, and D. A. Anderson.
Transactions of the ASAE, Vol 23, No 2, p 387-392, 1980. 1 Fig, 7 Tab, 8 Ref. OWRT B-035-WYO(8), 14-34-0001-7201.

Descriptors: *Lawns, *Sprinkler irrigation, *Application methods, Irrigation practices, *Water conservation, Irrigation efficiency, Municipal water, Testing procedures, Evaluation.

Distribution patterns of six typical lawn sprinkler types were determined during the summer of 1977. Tests were conducted on four sprinklers of each type under three pressure levels. Christiansen's Uniformity Coefficients (UCC) were calculated for the orginal pattern and for various overlaps of the sprinklers. Overlaps required to achieve minimum acceptable UCC values were then determined. The output of each sprinkler was measured and application rates were calculated for individual pattern sizes at the three pressure levels. Two important factors for effective lawn watering are: (1) use of the proper overlap for an individual sprinkler type, and (2) determining the application rate in order to apply the proper amount of water.
W81-00809

THE EVALUATION OF WATER CONSERVATION FOR MUNICIPAL AND INDUSTRIAL WATER SUPPLY: PROCEDURES MANUAL,
Planning and Management Consultants Ltd., Carbondale, IL.
For primary bibliographic entry see Field 6B.
W81-01000

3F. Conservation In Agriculture

WATER-CONSERVING WHEAT IRRIGATION SCHEDULES BASED ON CLIMATIC DATA,
Oklahoma Water Resources Research Inst., Stillwater.
M. B. Kirkham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-143661, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, 1980. 40 p, 4 Append. OWRT-B-045-OKLA(1), 14-34-0001-9129.

Descriptors: *Oklahoma, *Irrigation efficiency, *Wheat, *Irrigation practices, Scheduling, Agriculture, Crop response, Irrigation programs, Water conservation, Semiarid climates, Rainfall, Plant growth, Groundwater, Climatic data.

Irrigation schedules were developed based on correlations between yield and rainfall for the Oklahoma area. Historical records show that wheat yields are best when rain falls within a five day interval in late March. Past irrigation scheduling did not call for water applications to begin until after April 1. The records used to develop the correlations were for spring rainfall and grain yield on winter wheat grown between 1960 and 1977 at Stillwater and Goodwell, Oklahoma. Dates of high correlation were identified and field plots were established to test the resulting revised irrigation schedule. The revised schedule called for 15.2 cm of water applied in 7.6 cm increments on March 20 and April 24. The other schedule, the normal schedule, called for 22.8 cm of water applied in 7.6 cm increments on March 20, April 3, and April 24. A control of plants grown dryland was also used. To quantify plant water stress, plants were monitored for water potential, osmotic potential, stomatal resistance, and leaf temperature. Results show that greater water-use efficiency and higher yields were obtained with the revised irrigation schedule. Four related publications resulting from Office of Water Resources and Technology funding are attached. (Seigler-IPA)
W81-00811

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

A SYSTEMS APPROACH TO SOLVING RESOURCE ALLOCATION PROBLEMS WITH MULTIPLE OBJECTIVES,
California Univ., Los Angeles. Dept. of Engineering Systems.
G. A. O'Keefe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-140683, Price codes: A04 in paper copy, A01 in microfiche. M.S. Thesis, 1980. 45 p, 5 Fig, 8 Tab, (California Water Resources Center Project UCAL-WRC-W-576). OWRT-A-077-CAL(1).

Descriptors: *Resource allocation, *Model studies, *Economics, *Conjunctive use, Water management(Applied), Water storage, Water supply, Optimum development plans.

A resource allocation program is developed to assist in basin management where there are multiple objectives. The problem involves the allocation of: (1) water from groundwater and imported supplies to the users of a watershed, (2) wastewater from each user to the treatment plants of the region, and (3) treated water from the treatment plants to the disposal sites. The objectives which are of concern are minimization of the total cost of transporting and treating the water, and optimization of the water quality in the groundwater basin. The program consists of a simulation model, a single objective optimization model and a modification subroutine. The simulation model utilizes the Gauss-Seidel method of finite differences to solve the governing equations for groundwater flow and mass transport. Flow values for this model are obtained from the allocation pattern derived from the single objective optimization. The output from the simulation model is the final water levels and quality for the given allocation plan. An iterative procedure is then used to generate further allocation plans. This is done by varying the coefficients of the objective function in a consistent pattern so that an improvement in the second objective is obtained at each step. Three separate modification procedures are developed and tested, each one utilizing a different method to update the objective function. All three methods were found to be similar in their final results, the only major difference being rates of convergence and total cost. The program is tested on a hypothetical basin set up for this project, using each of the modification processes. All three methods traced the identical solution. (Snyder-Calif)
W81-00751

EXPANDED FLOOD PLAIN INFORMATION STUDY WILLOW, ALASKA.
Corps of Engineers, Anchorage, AK. Alaska District.
Report, June, 1980. 112 p, 11 Fig, 4 Tab, 23 Ref, 7 Append.

Descriptors: *Flood plains, *Flood forecasting, *Land use, *Urbanization, Planning, Flood damage, Flood stages, *Alaska, Computer models, Watershed management, Economic impact, Hydrologic aspects, Environmental effects, Habitats, Maps.

The Willow Creek area is the proposed site for a new capital city for Alaska. Hydrologic, economic and environmental information were developed for use as a decision framework for State and local officials relative to the implications of land use change, based on the existing (1978) land use condition and two assumed land use conditions. Three flood plain regulatory policies were also evaluated to determine their effects on future flood damage potential. A data management and comprehensive analysis system was developed for this area. The system is not limited to flood plain management aspects, but is also capable of addressing many other aspects of Water Resource Planning. The analyses centered on the use of a computerized grid cell data bank containing spatially specific data. The future land uses in the Willow Creek basin will increase the frequency and the depth of flooding. Encroachment on the flood plain will also increase flood stages and flood damages. Future flood damages can be reduced if future construction allows for the hydrologic effects of that development. Increased growth pressures will cause a conversion from rural to urban habitat types. Therefore, there will be a decrease in number and diversity of species and stability of community types. (Moore-SRC)
W81-00757

AQUATIC PESTS ON IRRIGATION SYSTEMS, IDENTIFICATION GUIDE,
Water and Power Resources Service, Denver, CO.
N. E. Otto, T. R. Bartley, and J. S. Thullen.
Available from Supt. of Documents, GPO, Washington, DC 20402. A Water Resources Technical Publication, Second Edition, 1980. 96 p, 37 Fig, 26 Ref.

Descriptors: *Irrigation systems, *Invertebrates, *Aquatic weeds, *Phreatophytes, *Nuisance algae, Aquatic plants, Submerged plants, Aquatic animals, Floating plants, Weeds.

Extensive infestations of obnoxious plants and certain aquatic animals cause problems on irrigation systems, such as reduction in carrying capacity of the system, increased evaporation and seepage, clogging of structures, adverse environmental impacts, and water loss through transpiration. This simplified identification guide was prepared in response to requests from irrigation project operators and other personnel involved with biological problems requiring identification aids. An illustration and narrative description are provided for some of the commonly observed organisms that become pests of irrigation systems in the Western United States. Submersed aquatic weeds, algae, floating aquatic weeds, emersed aquatic weeds, marginal weeds, woody plants (phreatophytes), and invertebrate aquatic animals are included. The illustrations include drawings of the entire organism, with inserts to depict key identifying features. (Moore-SRC)
W81-00760

THE EFFECT OF PHOTOCHEMICAL TREATMENT OF WATER ON ALGAL GROWTH,
Volcani Inst. of Agricultrual Research, Bet-Dagan (Israel). Inst. of Soil and Water.
A. J. Acher, and A. Elgavish.
Water Research, Vol 14, No 5, p 539-543, May, 1980. 3 Fig, 2 Tab, 17 Ref.

Descriptors: *Algae, *Growth rates, *Dyes, *Chlorophyta, *Dinoflagellates, Phytoplankton, Water quality, Lakes, Eutrophication, Laboratory tests, Solar radiation, Toxicity.

The effects of various concentrations of dye-sensitizer at different sunlight exposure times on the destruction of algae in batch cultures of three algae from Lake Kinneret were determined. The Lake is subject to algal blooms which impair its water quality, thus algal destruction was desirable. Peridinium, Pediastrum, or Cosmarium were inoculated in an artificial medium containing either rose

bengal (RB) or methylene blue (MB) and incubated in a controlled environment (20 plus or minus 2C, 14 hr light, 10 hr dark) for about 35 days. Some of the samples were sunlight-irradiated for intervals of 10-120 min prior to incubation. In Pediastrum cultures, the addition of 0.40 mg MB/liter or 1.50 mg RB/liter resulted in the complete destruction of algae after 7 days. The Peridinium cultures were destroyed with 0.50 mg MB/liter of 2.0 mg RB/liter after 15 to 25 days. In Cosmarium cultures 0.75 mg MB/liter of 1.20 mg RB/liter was required for algal destruction in 20 days. For Pediastrum and Peridinium, the dye concentrations necessary to achieve complete algal destruction in cultures exposed to sunlight were about half those required in cultures not subjected to solar radiation. In the case of Cosmarium, the MB concentrations were the same with or without sunlight exposure, but the incubation time for algal destruction was about half. In all experiments performed, MB showed a greater algicidal effect than RB. (McKeon-FRC)
W81-00771

AERATION AS A TOOL TO IMPROVE WATER QUALITY AND REDUCE THE GROWTH OF HYDRILLA,
University of South Florida, Tampa.
T. N. Cooley, P. M. Dooris, and D. F. Martin.
Water Research, Vol 14, No 5, p 485-489, May, 1980. 6 Fig, 2 Tab, 14 Ref.

Descriptors: *Model studies, *Aquatic weed control, *Aeration, *Water quality, *Nutrients, Lakes, Freshwater, Rooted aquatic plants, Aquatic weeds, Submerged plants, Bubbles, Oxygenation, Nitrogen, Carbon, Iron, Phosphorus, Calcium, Hydrogen ion concentration, Zinc, Magnesium, Trace metals, Essential nutrients, Plant growth, Water pollution.

The effects of aeration upon the macronutrients carbon, nitrogen, phosphorus, iron, calcium, and magnesium and some trace elements were examined in a model lake system. The use of aeration as a technique for the control of the aquatic rooted submerged plant Hydrilla verticillata was also examined. This plant has been recognized in Florida as a nuisance weed since the mid 1960's. Growth of Hydrilla was reduced by 20% fresh weight and 18% dry weight after an average of 21 days of aeration. Decrease in Hydrilla growth was attributed to oxygenation of the water and not the mechanical action of bubbling, as shown in studies with bubbles of pure nitrogen. Aeration caused a deterioration in general water quality. Aeration decreased inorganic carbon and nitrate-nitrite-nitrogen levels, while it caused elevations in dissolved oxygen levels and pH. No effects due to aeration were found on phosphate-phosphorus levels; however, decreases were noted in the concentrations of calcium, iron and zinc. After 7 days of aeration, iron levels decreased to less than 20 ppb. Iron depletion was significantly correlated with reduction of Hydrilla growth, and iron deficiency was suspected as the limiting factor in the model lake-Hydrilla system. (Geiger-FRC)
W81-00961

EFFECTS OF CHANGES IN SURFACE WATER REGIME AND/OR LAND USE ON THE VERTICAL DISTRIBUTION OF WATER AVAILABLE FOR WETLAND VEGETATION, PART I, DYNAMIC MODEL OF THE ZONE OF AERATION,
Arkansas Water Resources Research Center, Fayetteville.
R. N. MacCallum.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-145047, Price codes: A04 in paper copy, A01 in microfiche. Project Technical Completion Report, Publication No 70, June, 1980. 60 p, 7 Fig, 6 Tab, 51 Ref, 4 Append. OWRT-A-023-ARK(3).

Descriptors: *Mathematical models, *Wetlands, *Zone of aeration, *Algorithms, *Vegetation, *Arkansas, Kansas, Computer models, Groundwater movement, Hydrologic models, Model studies, Research and development, Mathematical studies, Mathematics, Vegetation effects, Hydrologic aspects, Hydrology, Planning, Seasonal, Transpiration, Precipitation(Atomspheric).

The primary objective of this study was to develop a dynamic mathematical model of the zone of aeration fo wetlands which describes the vertical distribution of water available for use by vegetation. A mathematical model reported by Green, Dabin, and Khare for simulating one-dimensional vertical groundwater movement in unsaturated soils of the Kansas prairie region, was adapted for use in a wetlands environment, typified by the Eastern Arkansas wetlands forest. The adapted model consisted of two second-order non-linear partial differential equations, and an algorithm for their numerical solution. The original model was extended to include functions for seasonal changes in transpiration and for drainage of excess precipitation. Prior to the addition of these two functions, model reliability was limited to one growth season. Interactions between hydrologic changes and long-term vegetative changes can be studied with the model. The model provides a potentially versatile management tool to assist prediction of the environmental impact of proposed flood control projects. The model was programmed for the IBM System 360 computer, and theoretical data pertinent to the Arkansas Delta region was developed. (Zielinski-IPA)
W81-00968

THE NATURE AND EFFECTS OF COUNTY DRAINAGE DITCHES IN SOUTH CENTRAL MINNESOTA,
Mankato State Univ., MN. Dept. of Biological Sciences.
H. W. Quade, K. W. Boyum, D. O. Braaten, D. Gordon, and C. L. Pierce.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-135451, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Center, University of Minnesota St. Paul, Bulletin Number 105, November, 1980. 135 p, 10 Fig, 47 Tab, 42 Ref. OWRT-A-040-MINN(7).

Descriptors: *Drainage effects, *Water quality, *Nutrients, *Sediment transport, *Minnesota, Rivers, Ditches, Runoff, Sediment distribution, Nutrient loading, Fluvial geomorpholoy, Nonpoint source pollution, Riparian Green Belt, Blue Earth County(MN), Le Sueur County(MN), Nicollet County(MN), Brown County(MN).

The extent of county drainage was determined for four counties in South Central Minnesota followed by a study of the gemorphic nature of man's drainage in contrast to natural drainage. Selected drainage ditches and low order rivers were sampled for water quality and quantity in order to determine the contributions and timing of nutrient loads from each. Seventy-nine percent of the drainage ditches were found to terminate into rivers and they more than doubled the length of the surface fluvial systems. The closeness of fit of the drainage ditch systems to the low order Strahler classification scheme suggests that man has taken an immature lake-marsh environment and within 100 years created a geomorphically mature fluvial landscape. Nutrient loading by ditches into receiving bodies was found to vary by season, by individual ditch or river, and by stream order indicating that each ditch was unique. Water quality of one ditch during this wet study year was compared to a previous dry year study and the nutrient loading data was consistent and predictable. The most significant loading nutrient chemical parameter to the Minnesota River was found to be nitrate-nitrogen. Flow showed flashy response to storm events in some ditches and some were quite conservative. Sediment load was directly correlated to flow.
W81-00976

4B. Groundwater Management

A COMPARISON OF ANALOG AND DIGITAL MODELING TECHNIQUES FOR SIMULATING THREE-DIMENSIONAL GROUND-WATER FLOW ON LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-00830

GROUND-WATER CONDITIONS AT BEALE AIR FORCE BASE AND VICINITY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. W. Page.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $8.75 in paper copy, $5.00 in microfiche. Geological Survey Open-File Report 80-204, April, 1980. 36 p, 7 Fig, 3 Plates, 12 Tab, 44 Ref.

Descriptors: *Groundwater resources, *Water quality, *Hydrogeology, *Aquifer characteristics, *California, Groundwater movement, Well data, Pumping, Water levels, Water supply, Water yield, chemical analysis, *Beale Air Force Base(CA), *Eastern Sacramento Valley(CA).

Ground-water conditions were studied in a 168-square-mile area between the Sierra Nevada and the Feather River in Yuba County, Calif. The area is in the eastern part of the Sacramento Valley and includes most of Beale Air Force Base. Source, occurrence, movement, and chemical quality of the ground water were evaluated. Ground water occurs in sedimentary and volcanic rocks of Tertiary and Quaternary age. The base of the freshwater is in the undifferentiated sedimentary rocks of Oligocene and Eocene age, that contain water of high dissolved-solids concentration. The ground water occurs under unconfined and partly confined conditions. At Beale Air Force Base it is at times partly confined. Recharge is principally from the rivers. Pumpage in the study area was estimated to be 129,000 acre-feet in 1975. In the 1960's, water levels in most parts of the study area declined less rapidly than in earlier years or became fairly stable. In the 1970's, water levels at Beale Air Force Base declined only slightly. Spacing of wells on the base and rates of pumping are such that excessive pumping interference is avoided. Water quality at the base and throughout the study area is generally good. Dissolved-solids concentrations are 700 to 900 milligrams per liter in the undifferentiated sedimentary rocks beneath the base well field. (USGS)
W81-00832

GROUND WATER OVERDRAFTING MUST BE CONTROLLED.
General Accounting Office, Washington, DC.
Available from Supt. of Documents, GPO, Washington, DC 20402. Comptroller General's Report to the Congress, CED-80-96, September 12, 1980. 56 p, 7 Append.

Descriptors: *Overdraft, *Groundwater mining, *Water management(Applied), *Groundwater resources, Saline water intrusion, Aquifers, Water conservation, Water resources development, Water demand, Land subsidence, Surface-groundwater relationships, Pumping, Planning.

The demand for water in many areas of the country is being met by overdrafting ground water. Overdrafting is most serious in the arid and semiarid western states where irrigation of crops accounts for over half of all ground water use. Subsidence caused by overdrafting has caused millions of dollars in damage to surface structures. In coastal areas where ground water levels are lowered by overdrafting the normal flow of freshwater to the ocean is reversed, and salt water moves into freshwater areas. In inland aquifers intrusion may occur when salt water migrates vertically and horizontally into freshwater aquifers. Where surface streams and rivers are geologically interrelated with the underlying ground water aquifers, surface flow may be reduced by overdrafting. When a ground water aquifer is continually overdrafted, the level of the aquifer declines, and more energy is required to pump the water from greater depths It is recommended that the Congress direct the Departments of Agriculture, the Army, and the Interior to require that affected states and commu-

nities implement or have plans to implement a program for controlling ground water pumping, and a conservation program before the start of federally funded water resources or ground water mitigation projects. (Moore-SRC)
W81-00990

4C. Effects On Water Of Man's Non-Water Activities

STREAM-WATERSHED RELATIONSHIPS IN THE MISSOURI OZARK PLATEAU PROVINCE,
Missouri Univ.-Columbia.
M. M. Smart.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-143398, Price codes: A09 in paper copy, A01 in microfiche. PhD Dissertation, August, 1980. 170 p, 12 Fig, 22 Tab, 94 Ref. OWRT-A-111-M0(1), 14-34-0001-9027.

Descriptors: *Land use, *Effects, *Water quality, Streams, Water chemistry, *Watersheds(Basins), *Missouri, Urban drainage, Pastures, Forest watersheds, Evaluation.

Land use is the most influential watershed characteristic determining chemical concentrations of 23 streams that drained watersheds with different land uses, geologic bedrock, and soil associations in the Missouri Ozark Plateau Province. Streams draining watersheds with urban land use had the highest chemical concentrations and streams draining forest watersheds the lowest. Streams draining pasture watersheds were intermediate, more closley resembling streams in overall salinity, and urban streams in nitrogen and phosphorus. Nutrient concentrations increase along a continuum in response to the area of urban or pasture area on the watershed and decrease with increasing forest area. Algal biomass was governed by plant nutrients, streamflow, and morphological characteristics of the stream. Planktonic biomass was determined by TP and NH sub 3-N and is derived from benthic populations. Prediction of stream chemical concentrations and algal biomass from watershed land use can be used to assess changes in streams that may occur as the result of changes on the watershed.
W81-00803

STREAM-WATERSHED RELATIONS IN THE MISSOURI OZARK PLATEAU PROVINCE,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
J. R. Jones, and M. M. Smart.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-149635, Price codes: A07 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri, Completion Report, November, 1980. 140 p, 7 Fig, 16 Tab, 94 Ref, 2 Append. OWRT-A-111-MO(2), 14-34-0001-9027 & 0127.

Descriptors: *Land use, *Environmental effects, *Ecology, *Watersheds(Basins), *Missouri, Water pollution sources, Urban runoff, Forests, Pastures, Nutrients, Dissolved solids, Streamflow, Non-point sources, Streams, *Missouri Plateau Province.

Land use is the most influential watershed characteristic determining chemical concentrations of 23 streams that drained watersheds with different land uses, geologic bedrock, and soil associations in the Missouri Ozark Plateau Province. Streams draining watershed with urban land use had the highest chemical concentrations and streams draining forest watershed the lowest. Streams draining pasture watersheds were intermediate, more closely resembling streams in overall salinity, and urbans streams in nitrogen and phosphorus. Nutrient concentrations increase along a continuum in response to the area of urban or pasture area on the watershed and decrease with increasing forest area. Algal biomass was governed by plant nutrients, streamflow, and morphological characteristics of the stream. Planktonic biomass was determined by TP and NH3 -N and is derived from benthic populations. Prediction of stream chemical concentrations and algal biomass from watershed land use can be used to assess changes in streams that may occur as the result of changes on the watershed.
W81-00978

MANAGING IMPACTS OF PETROLEUM DEVELOPMENT IN BRACKISH MARSHES,
General Land Office of Texas, Austin.
For primary bibliographic entry see Field 5C.
W81-00998

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

EVALUATION OF PROCEDURES FOR RECOVERY OF VIRUSES FROM WATER-II. DETECTION SYSTEMS,
Severn Trent Water Authority, Coventry (England). Regional Lab.
R. Morris, and W. M. Waite.
Water Research, Vol 14, No 7, p 795-798, July, 1980. 3 Tab, 15 Ref.

Descriptors: *Viruses. *Rivers, *Monitoring, Cultures, Pollutant identification, Cytological studies, Aquatic environment, Water pollution, Testing procedures, Laboratory tests.

The feasibility of one human and two monkey cell systems in monolayers in tubes and flasks and in agar-suspended cells for detecting enteroviruses in river water samples was examined in laboratory tests. Monkey Vero cells proved to be inefficient for the detection of viral pollution. The Buffalo green monkey (BGM) cells generally gave the best recoveries, while the results of virus recovery using the human rhabdomyosarcoma (RD) cells were variable. Cell culture presentation played a major role in the efficiency of viral recovery. Agar suspensions afforded the best recovery of viruses from water samples, followed by tube cultures of cells, then by cell monolayers in flasks. Tests performed on water from the River Sowe using the BGM-agar suspended cell system yielded virus levels varying from 145 to 620 plaque-forming units/liter. The same test method used on the River Avon showed that much lower virus concentrations were present in this river, with an occasional high count of 540 plaque-forming units/liter being detected. It was concluded that BGM- and RD-agar suspended cells were satisfactory for the routine monitoring of aquatic environments. (See also W81-00766) (Geiger-FRC)
W81-00767

THE ANALYSIS AND FATE OF ODOROUS SULFUR COMPOUNDS IN WASTEWATERS,
Los Angeles County Sanitation Districts, Whittier, San Jose Creek Water Quality Lab. CA.
For primary bibliographic entry see Field 7B.
W81-00776

OBTAINING PRECISE ESTIMATES IN COLIFORM ENUMERATION,
College of Staten Island, NY. Dept. of Biology.
For primary bibliographic entry see Field 7B.
W81-00782

ATP AS AN INDICATOR OF TOXICITY,
Texas A and M Univ., College Station. Dept. of Oceanography.
M. C. Kennicutt, II.
Water Research, Vol 14, No 4, p 325-328, April, 1980. 6 Fig, 7 Ref.

Descriptors: *Adenosine triphosphate, *Bioindicators, *Water pollution sources, *Pollutant identification, Aquatic ecosystems, Monitoring, Aquatic life, Toxicity, Sterilants, Organic compounds, Laboratory tests, Analytical techniques, Bioassay, Hydrogen ion concentration.

As previous studies of sewage sludge and water purification techniques had suggested that adenosine triphosphate was a potential candidate as a toxicity indicator, the value of ATP as an indicator of aquatic environmental pollution was examined in laboratory tests. The use of different chemicals for aquatic sample sterilization was also studied. ATP levels were measured using the luciferin-luciferase technique, and the toxins tested were chloroform, acetone, acrolein, and mercuric chloride. Chloroform at 5 ppm induced a 40% reduction in ATP levels after 6 hr of exposure. Mercuric chloride at 1 ppm induced 100% loss of ATP in only 1 hr. Reductions of ATP levels by highly acidic or highly basic pH values were also demonstrated. Since all living organisms contain ATP, the use of this compound as a sensitive indicator of potential pollutants in aquatic environments is recommended for routine use in conjuction with other lethal and sublethal tests for determining aquatic toxicity. The ATP tests also offer rapid results and can be used on a variety of natural waters provided pH parameters are taken into account. Mercuric chloride was preferred over chloroform as an agent to sterilize aquatic samples. (Geiger-FRC)
W81-00783

REDUCTION OF COLIFORM BACTERIA IN TWO UPLAND RESERVOIRS: THE SIGNIFICANCE OF DISTANCE DECAY RELATIONSHIPS,
Leeds Univ. (England). School of Geography.
D. Kay, and A. McDonald.
Water Research, Vol 14, No 4, p 305-318, April, 1980. 7 Fig, 10 Tab, 42 Ref.

Descriptors: *Reservoirs, *Coliforms, *Fluctations, Theoretical analysis, Self-purification, Rainfall, Surface waters, Water quality, Pathogenic bacteria, Limnology, Land use, *England.

Two British upland reservoirs with multiple-use catchment areas were studied from September 1976 to September 1977 for coliform bacteria densities. The catchment-use level is defined in terms of recreation and agriculture. Purification rates for the reservoirs were calculated for different limnological conditions. Results showed that peak loadings of bacteria would occur following heavy rainfalls when waters fill depleted reservoirs. A model is presented that utilizes logarithmic bacterial decay to estimate self-purification by the reservoir. Reduction of coliform bacteria in other reservoirs was examined for comparison. Results indicated that the distance-decay relationships presented were applicable only to the individual impoundment for which they were calculated. The distance-dependent decay function may serve as a useful concept for the catchment manager, to predict not the exact outlet coliform levels but the order of magnitude of purification that could be expected. (Geiger-FRC)
W81-00785

A PRESSURIZED PROPORTIONAL DILUTER FOR AQUATIC TOXICOLOGICAL STUDIES,
Environmental Protection Agency, Gulf Breeze, FL. Gulf Breeze Environmental Research Lab.
For primary bibliographic entry see Field 5C.
W81-00795

ZOOPLANKTON GRAZING AS A CONTROL MECHANISM IN ALGAL BLOOMS. A METHOD FOR THE STUDY OF THE EFFECT OF ALGAL TOXINS ON ZOOPLANKTON VERTICAL MIGRATION,
New Hampshire Univ., Durham. Dept. of Zoology.
For primary bibliographic entry see Field 7B.
W81-00804

ANALYSES OF WATER AND DREDGED MATERIAL FROM SELECTED SOUTHERN LOUISIANA WATERWAYS AND SELECTED AREAS IN THE GULF OF MEXICO, 1976-78,
Geological Survey, Baton Rouge, LA. Water Resources Div.
G. R. Stallworth, and H. F. Jordan.
Available from the OFSS, USGS Box 25425, Fed.

Ctr., Denver, CO 80225, Price: $20.75 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 80-694, June, 1980. 141 p, 9 Plates, 12 Tab, 12 Ref.

Descriptors: *Chemical analysis, *Water analysis, *Dredging, *Environmental effects, *Inland waterways, Water quality, Louisiana, Gulf of Mexico, Basic data collections, Biochemical oxygen demand, Chlorophyll, Coliforms, Effluents, Nutrients, Pesticides, Trace elements, Southern Louisiana waterways.

The U.S. Geological Survey was requested by the U.S. Army Corps of Engineers to provide water-quality data to evaluate the potential environmental effects of (1) dredging activities in selected navigable waterways of southern Louisiana and (2) the disposal of dredged material at selected areas in the Gulf of Mexico. Areas studied from September 1976 to May 1978 included five ocean disposal sites in the Gulf of Mexico, in addition to the following waterways: Baptiste, Collette Bayou, Mississippi River at Head of Passes and Southwest Pass, Mississippi River at Tiger Pass, Bayou Black, Intracoastal Waterway (Port Allen to Morgan City), and Calcasieu River and Ship Channel. Samples were analyzed for selected chemical, physical, and biological constituents. (USGS)
W81-00836

SEMI-QUANTITATIVE DETERMINATION OF FULVIC ACID, TANNIN AND LIGNIN IN NATURAL WATERS,
National Water Research Inst., Burlington (Ontario).
J. Lawrence.
Water Research, Vol 14, No 4, p 373-377, April, 1980. 2 Fig, 4 Tab, 15 Ref.

Descriptors: *Spectrophotometry, *Lignins, *Fulvic acids, Organic compounds, Organic acids, Humic acids, Decomposing organic matter, Aromatic compounds, Water analysis, Wavelengths.

The simultaneous, semiquantitative determination of fulvic acid, tannin and lignin by ultraviolet spectrophotometry is described. Three different wavelengths are used to measure absorbance. Concentrations are calculated using an expanded form of Beer's Law. The method compares well to other analytical methods for naturally occurring organic compounds. The method has accuracy of less than 15% for fulvic acid, less than 30% for tannic acid and less than 50% for lignosulfonic acid. (Baker-FRC)
W81-00868

BIOLOGICAL MONITORING. PART I-EARLY WARNING SYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. Cairns, Jr., and W. H. Van Der Schalie.
Water Research, Vol 14, No 9, p 1179-1196, September, 1980. 1 Tab, 165 Ref.

Descriptors: *Monitoring, *Reviews, *Water pollution, *Aquatic ecosystems, Pesticides, Waste disposal, Toxicity, Respiration, Nitrification, Environmental effects, Water pollution control, Public health, Fish toxins, Metals, Chlorinated hydrocarbon pesticides.

The first report focusing on early warning systems from a symposium on biological monitoring consisting of six separate reports is presented in a review format. Natural systems have been threatened by contamination with improperly disposed wastes, as was witnessed in large-scale incidents with mercury poisoning and Kepone (chlordecone) pollution. Many chemicals pose a threat to human health as potential carcinogens. Management programs for the disposal of wastes will be needed to assess the ecological impact of various compounds on the environment. Early warning systems will ideally have test organisms exposed in field or laboratory situations to toxins under continuous flow conditions. A physiological or behavioral parameter of the organism should be monitored by a device capable of sensing abnormal responses. Short term changes as opposed to chronic effects are monitored in early warning toxicity tests. Some tests that are applicable to early warning toxicity monitoring include bacterial ATP and porphyrin tests indicating changes in bacterial numbers, oxygen consumption tests, nitrification and various macroinvertebrate response tests. Effects of DDT, carbaryl and dieldrin on heart rate of fish have been investigated. Response times of aquatic organisms to various metals and pesticides including lindane, DDT, pentachlorophenol, endrin, chlordane and parathion are given. Three scenarios for regulation of specific toxicants are outlined which might be implemented for the control of waste disposal. (Geiger-FRC)
W81-00880

PRELIMINARY ESTIMATE OF MERCURY POLLUTION IN THE FRENCH MEDITERRANEAN (PROVENCE-COTE D'AZUR) BY STUDYING CONTAMINATION LEVELS IN SEDIMENTS AND BENTHIC ORGANISMS (PREMIERE ESTIMATION DE LA POLLUTION MERCURIELLE DU LITTORAL MEDITERRANEEN FRANCAIS (PROVENCE-COTE D'AZUR) PAR L'ETUDE DU DEGRE DE CONTAMINATION DES SEDIMENTS ET DES ORGANISMS BENTHIQUES),
Centre Universitaire de Luminy, Marseille (France).
H. Augier, G. Gilles, and G. Ramonda.
Progress in Water Technology, Vol 12, No 1, p 97-108, 1980. 1 Fig, 1 Tab, 26 Ref.

Descriptors: *Sea water, *Benthic fauna, *Mercury, *Bioindicators, *Effluents, Sewers, Water pollution, Cities, Sediments, Industrial wastes, Europe, Sewage, Spectrophotometry, Mediterranean, France.

Flameless atomic absorption spectrophotometry was used to determine mercury levels in marine sediments and benthic plants and animals in the French Mediterranean. Thus, the degree of mercury pollution was estimated. Three species were used as biological indicators of mercury pollution: the red alga Ceramium ciliatum, the marine phanerogam Posidonia oceanica, and the mussel Mytilus galloprovincialis. Highest mercury levels were found in the urban and industrial areas of Marseille and the Gulf of Fos. Mercury concentrations at the Cortiou sewer outfall reached 14.5 ppm in sediments, 0.73 ppm in the sea urchin, 2.90 ppm in the sea cucumber, and 51.50 ppm in the leaves of Posidonia oceanica. These results combined with others indicated that urban sewage, which contains industrial wastes, is a major source of pollution. The pollution, however, was not found to reach dangerous levels. (Small-FRC)
W81-00890

THE CAVTAT ACCIDENT: EVALUATION OF ALKYL LEAD POLLUTION BY SIMULATION AND ANALYTICAL STUDIES,
Istituto di Recercha sulle Acque Bari (Italy).
For primary bibliographic entry see Field 7B.
W81-00895

DETERMINATION OF POLYOXYETHYLENE ALKYL ETHER NON-IONIC SURFACTANTS IN WATERS AT TRACE LEVELS AS POTASSIUM PICRATE ACTIVE SUBSTANCES,
Trieste Univ. (Italy). Inst. di Merceologia.
L. Favretto, B. Stancher, and F. Tunis.
Analyst, Vol 105, No 1254, p 833-840, September, 1980. 4 Fig, 3 Tab, 28 Ref.

Descriptors: *Surfactants, *Chemical precipitation, *Testing procedures, *Chemical reactions, *Physical properties, Soaps, Detergents, Water pollution sources, Wastes, Analytical techniques, Chemical properties, Organic compounds, Trace elements.

A method for absolute determination of polyoxyethylene alkyl ether non-ionic surfactants is proposed, in which potassium picrate is used as a precipitating agent. Application of the method to both mono- and poly-disperse surfactants is considered, and the reactivity of these is compared with the reactivity of other p-tert-nonylphenyl surfactants. Non-ionic surfactants, which are widely used in household detergent formulas and derived from industrial production, occur in trace levels in waters receiving untreated urban liquid wastes. Potassium picrate was added to varying concentrations of surfactant. The organic layer was extracted with 1,2-dichloroethane, centrifuged, and the absorbance was measured at 378 nm against the reagent blank. In all instances, the results demonstrated the validity of Beer's Law at trace levels. In all cases a second extraction produced small but significant absorbance. It was shown that n-dodecyl and p-tert-nonylphenyl monodisperse surfactants display maximum slopes of the calibration curves, converging to a limiting value with increasing degrees of polymerization. In polydisperse surfactants, no maximum is observed, but they tend toward the same limit as monodisperse surfactants. This method is effective for surfactants with polyoxyethylene chains which are too short to be precipitated with conventional methods. (Titus-FRC)
W81-00898

SIMPLIFIED METHOD FOR THE DETERMINATION OF CADMIUM, CHROMIUM, COPPER, NICKEL, LEAD AND ZINC IN SEWAGE SLUDGE USING ATOMIC-ABSORPTION SPECTROPHOTOMETRY,
Severn-Trent Water Authority, Malvern (England). Malvern Regional Lab.
K. C. Thompson, and K. Wagstaff.
Analyst, Vol 105, No 1254, p 883-896, September, 1980. 1 Fig, 13 Tab, 34 Ref.

Descriptors: *Heavy metals, *Sewage sludge, *Spectrophotometry, Analytical techniques, Chemical analysis, Cadmium, Chromium, Copper, Nickel, Lead, Zinc, Separation techniques, Testing procedures, Sludge disposal.

The deposition of digested sewage sludge on land may increase levels of certain toxic metals in the soil. An accurate, safe, rapid and simple method for analysis of these metals is presented, using nitric acid digestion in 50 ml calibrated glass tubes for the routine atomic absorption determination of cadmium, chromium, copper, nickel, lead, and zinc. Both wet and dried sludge can be analyzed by this technique. The use of a calibrated tube has advantages over the conventional beaker digestion in respect to the amount of volumetric apparatus required, the ease of digestion and the amount of space needed. Other digestion reagents such as aqua regia, nitric acid-hydrogen peroxide and nitric acid-perchloric acid can also be used with this method. The fractions insoluble in nitric acid were not significant in relation to the disposal of sewage sludge on agricultural land. (Baker-FRC)
W81-00899

RAPID AND SENSITIVE SPECTROPHOTOMETRIC METHOD FOR THE DETERMINATION OF NITRATE IN RAIN WATER USING 3,4-XYLENOL,
Ibadan Univ. (Nigeria). Dept. of Chemistry.
O. Osibanjo, and S. O. Ajayi.
Analyst, Vol 105, No 1254, p 908-912, September, 1980.

Descriptors: *Spectrophotometry, *Nitrates, Rain water, Nitrites, Chlorides, Analytical techniques, Water pollution, Fertilizers, Monitoring, Separation techniques.

An improved spectrophotometric method for determining nitrate in rain water has been developed using 3,4-xylenol. The reagent is nitrated at 0 degrees in 80% sulfuric acid, and the nitration product is extracted into toluene. The excess reagent remains in the aqueous layer. The toluene layer is treated with sodium hydroxide solution to produce a colored sodium salt of nitrophenol. The absorbance of the colored complex is measured at 432 nanometers. No significant interferences occurred in the presence of chloride. Bromide caused interference at 1:100 levels and above, and nitrite at 1:10 and above. Bromide interferences could be corrected with additions of silver sulfate or mercury sulfate, and nitrite interference was corrected by addition of sulfamic acid. Percent recovery of nitrate from spiked samples ranged from 96 to

108%. The technique may also be used for routine determination of nitrate in soils, river sediments and mineral oils. (Geiger-FRC)
W81-00900

IDENTIFICATION OF CHRYSOTILE ASBESTOS BY MICRODIFFRACTION,
Dow Chemical Co., Midland, MI.
D. R. Beaman, and H. M. Baker.
Analytical Chemistry, Vol 52, No 12, p 1983-1984, October, 1980. 1 Fig, 1 Tab, 20 Ref.

Descriptors: *Asbestos, *Electron microscopy, *Pollutant identification, Analytical techniques, Industrial effluents, Spectroscopy, Crystallography.

The analysis of asbestos in waste water effluents, especially of high solids and low chrysotile contents, by transmission electron microscopy presents some inconveniences. The selected area electron diffraction patterns (SAED) on which current asbestos analyses are based pose several problems. One major problem lies in the lack of a consistent classification scheme. Many patterns are initially incomplete, and others will fade within 30 sec to such an extent as to be unidentifiable. This is caused by electron beam induced degradation due to dehydroxylation and carbon contamination. This problem, coupled with differences in instruments, and the presence of fiber coatings or interfering crystalline solids, makes SAED identification unreliable. Subjecting individual fibers to elemental analysis with an energy dispersive spectrometer (EDS) can improve the situation. The use of the microdiffraction mode rather than SAED can aid identification in the diffraction portion of the method. Such analysis provides stable patterns which do not fade in the time required for anlysis of chrysotile asbestos in water and air samples. The EPA interim method with SAED replaced by microdiffraction could be used to test relatively clean water samples such as those from lakes or from tap water. (Baker-FRC)
W81-00901

ACTIVATED SLUDGE CONTROL IN THE SECONDARY SETTLING BASIN USING THE SLUDGE SETTLING ANALYZER,
Kanazawa Univ. (Japan). Dept. of Construction and Environmental Engineering.
For primary bibliographic entry see Field 5D.
W81-00912

SOME PROBLEMS IN THE DETERMINATION OF TOTAL RESIDUAL 'CHLORINE' IN CHLORINATED SEA-WATER,
Old Dominion Univ., Norfolk, VA. Inst. of Oceanography.
G. T. F. Wong.
Water Research, Vol 14, No 1, p 51-60, 1980. 6 Fig, 28 Ref.

Descriptors: *Volumetric analysis, *Chlorine, *Sea water, Chlorination, Analytical techniques, Chemical analysis, Effluents, Halogens, Bromine.

Significant errors may occur in using the amperometric titrimetric method to determine the amount of residual chlorine in chlorinated sea water unless specific precautions are taken. If the pH 4 buffer is added to the sample before the potassium iodide solution is added, serious analytical errors will result. Even if the reagents are added only seconds apart, the error will be significant, probably due to the volatilization of molecular bromine. In freshwater samples this practice should also be avoided, as loss of molecular chlorine may result. Even when the potassium iodide is added first, care must be taken to add the acidic buffer not more than 1 minute afterwards. Iodate present in sea water may cause significant uncertainty in determining small quantities of residual chlorine. Clear definitions in the literature for reporting the concentrations of residual chlorine are necessary. The preferred unit is micromolar concentration of hypohalite. (Baker-FRC)
W81-00917

ROLE OF STRONG ION EXCHANGE RESINS IN NITROSAMINE FORMATION IN WATER,
Science and Education Administration, Philadelphia, PA. Eastern Regional Research Center.
W. I. Kimoto, C. J. Dooley, J. Carre, and W. Fiddler.
Water Research, Vol 14, No 7, p 869-876, July, 1980. 9 Tab, 14 Ref.

Descriptors: *Ion exchange, *Resins, *Organic compounds, Potable water, Cations, Anions, Water analysis, Nitrogen compounds, Nitrosamines, Water pollution sources, Toxins, Ammonia.

The passing of tap water through a column containing only anion exchange resin caused formation of N-nitrosodimethylamine (NDMA). This indicated that nitrosamine formation by conventional acid catalyzed nitrosation was not the primary mechanism in NDMA formation. It is suggested that the quaternary ammonium ion of the strong anion resin may be the amine precursor for nitrosamine formation. Low levels of NDMA added to the influent were not able to be concentrated by strong anion and strong cation resins such as Amberlite and Dowex brands. Thus it was concluded that low levels of nitrosamine already present in the water do not contribute significantly to the concentration of nitrosamines found in deionized water. Normal levels of cations, anions, and heavy metals were similarly not responsible for the nitrosamines present in the water after passing through the column. An unknown substance was isolated in tapwater that promoted nitrosamine formation. This substance was able to be removed from the water either by activated carbon treatment or by degassing techniques. (Baker-FRC)
W81-00922

DETERMINATION OF NITRITE ION IN WASTE AND TREATED WATERS BY RESONANCE RAMAN SPECTROMETRY,
Meidensha Electric, Tokyo (Japan). Water Treatment Engineering Div.
N. Furuya, A. Matsuyuki, S. Higuchi, and S. Tanaka.
Water Research, Vol 14, No 7, p 747-752, July, 1980. 7 Fig, 4 Ref.

Descriptors: *Analytical techniques, *Pollutant identification, *Spectrometers, *Nitrites, Nitrates, Chemical analysis, Dyes, Waste water treatment, Water analysis, Resonance.

Resonance Raman spectrometry has been used to determine the concentration of nitrite ions in waste water. As the Raman spectrometry technique requires a colored product for identification, the nitrite is converted to an azo dye product by chemical reaction. The addition of sodium thiocyanate during the procedure reduced the background interference to such a degree that the sensitivity of this method is rated at about 0.5 ppb, which is approximately one order of magnitude lower than the sensitivity of the colorimetric method usually employed for such determinations. The analytical curve obtained for the aqueous solutions of nitrite ion in the concentration range from 10 to 180 ppb fit well enough to a straight line in the concentration range below 140 ppb. The standard deviation for the straight line is very small, 2.70 ppb. Thus the sensitivity of this method is high enough for optimum control of waste water treatment and the technique is practical for waste and treated water samples. The simultaneous determination of nitrite ion and nitrate ion utilizing this process was proposed. (Baker-FRC)
W81-00927

A MODEL PROVISION FOR NON-DEGRADATION OF GROUNDWATER: WHAT IS A DETRIMENTAL EFFECT AND WHERE IS IT MEASURED,
Wisconsin Univ.-Oshkosh. Coll. of Letters and Science.
J. I. Hoffman.
In: Third Annual Madison Conference of Applied Research & Practice on Municipal & Industrial Waste, September 10-12, 1980, p 168-173, 1980. 3 Ref. University of Wisconsin-Extension, Department of Engineering & Applied Sciences, 432 N. Lake Street, Madison, WI 53706.

Descriptors: *Wisconsin, *Aquifer testing, *Waste water(pollution), *Water quality control, *Waste disposal, Degradation, Monitoring, Geochemistry, Attenuation, Reservoirs, Pollution, EPA, Contamination, Subsurface drainage, Water quality standards, Path of pollutants, Model studies, Groundwater.

Non-degradation and zero pollution of water are goal statements which in practice cannot be achieved. Therefore, some measurable parameters must be set so that activities necessary for the existence of society can be evaluated as to compliance with a reasonable standard. A model framework for groundwater protection is presented. The goal should be that no activity will cause a statistically significant deviation from the main geochemistry of the groundwater existing beneath or in potential contact with a proposed activity. For waste disposal facilities, a compliance point is defined as the lesser of 1,200 feet from the source or the project property line, and an intervention point is established at one-half of the above distance. The intervention point is the place where measurements against the standards are to be taken, and correction action employed if necessary. For hazardous wastes, or large activities which involve a site of more than 100 acres, a computer model of groundflow and contamination should be required. (Garrison-Omniplan)
W81-00935

DETERMINATION OF TRIHALOMETHANES (THM) IN WATER USING HIGH EFFICIENCY SOLVENT EXTRACTION,
National Swedish Environment Protection Board, Stockholm (Sweden). Dept. of Environmental Hygiene.
H. Norin, and L. Renberg.
Water Research, Vol 14, No 10, p 1397-1402, October, 1980. 5 Fig, 3 Tab, 18 Ref.

Descriptors: *Gas chromatography, *Organic compounds, *Potable water, *Solvent extractions, *Separation techniques, Analytical techniques, Disinfection, Organic wastes, Monitoring, Rivers, Water pollution, Industrial wastes, Pulp wastes, Trihalomethanes.

A method for the gas chromatographic determination of trihalomethanes (THM) in water using solvent extraction is described. Volatile halogenated hydrocarbons occur in drinking water, natural water and waste waters as a result of industrial pollution or disinfection processes. In the present technique, the organic phase was extracted into a mixture of hexane and diisopropyl ether and was analyzed by gas chromatography. Mean recoveries of THM ranged from 89.0 to 106.0% in spiked samples when a solvent:water ratio of 1:50 was used. Ascorbic acid was recommended for preservation of water samples until analysis time, rather than sodium thiosulfate. The technique has been applied to the monitoring of THM levels in Swedish drinking water and the estimation of THM occurrence in pulp and paper mill effluents. Problems of emulsion formation in the latter studies due to high organic content were overcome by centrifugation. Of the 107 drinking water samples studied, 90% had THM levels in the range of 0.2-25 micrograms/liter. (Geiger-FRC)
W81-00936

A CONVENIENT PARAMETER FOR TRACING LEACHATE FROM SANITARY LANDFILLS,
Wollongong Univ. (Australia). Dept. of Chemistry.
J. Ellis.
Water Research, Vol 14, No 9, p 1283-1287, September, 1980. 1 Fig, 2 Tab, 16 Ref.

Descriptors: *Potassium, *Tracers, *Municipal wastes, *Path of pollutants, *Leaching, Groundwater movement, *Waste dilution, Landfills, Biochemical oxygen demand, Waste disposal, Leachate, Ion transport, Groundwater, Water pollution, Microbial degradation, Chemical degradation, Clays, Discharge.

Large amounts of material of vegetable origin have been identified in typical samples of municipal

wastes. Such constituents are subject to microbial and chemical breakdown producing high biochemical oxygen demands. As a result elevated levels of potassium often occur in the leachate and may serve as an accurate and easily measurable tracer for wastes. Studies of potassium ion levels in water samples collected at monthly intervals from three sampling sites at Russell Vale show this parameter served as a clean indicator of leachate pollution of groundwater. Potassium ion measurements also revealed the direction of movement of the leachate as illustrated in correlations of potassium ion concentrations in waters downstream from a landfill to levels upstream. Potassium ions could not be used to monitor leachate contributions when the inherent water level of this ion was high, when extended passage of leachate through potassium-absorbing clay strata was expected, or when leachate was derived from landfills receiving mainly industrial wastes. Although the cover material was shown previously not to be a source of potassium ion enrichment, care should be taken not to measure possible potassium ion contribution from contact with agricultural fertilizers, concrete and other odd cation sources. (Geiger-FRC)
W81-00942

EVALUATION OF A PORTABLE BARE-ELECTRODE AMPEROMETRIC ANALYZER FOR DETERMINING FREE CHLORINE IN POTABLE AND SWIMMING-POOL WATERS,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
E. Canelli.
Water Research, Vol 14, No 10, p 1533-1540, October, 1980. 1 Fig, 8 Tab, 17 Ref.

Descriptors: *Potable water, *Swimming pools, *Amperometry, *Analytical techniques, *Chlorine, Titration, On-site tests, Sampling, Laboratory tests, Water analysis, Water pollution.

The determination of chlorine as HOCl or ClO(-) was carried out by a bare-electrode portable amperometric analyzer in samples of potable and swimming pool water. The method used no titration and gave rapid and precise results for chlorine levels ranging from 0.10 to 3.0 ppm chlorine. Stoichiometrically equivalent signals were noted for hypochlorite and bromine, triiodide ion, and Mn(VII), but no detectable amperometric signals were observed from MnO2. Interference was observed from N-chloroglycine, NH2Cl, NHCl2 and NCl3. Monochloroisocyanurate, chlorinated bovine albumin, and chlorinated urea gave amperometric signals which were lower than those produced by the N,N-diethyl-p-phenylenediamine (DPD) procedure. When potable water samples were analyzed for free chlorine using the DPD and amperometric method, no significant differences were found between the two sets of results. Field and laboratory tests on swimming pool water samples using both techniques resulted in slightly higher free chlorine values when the DPD method was used. This discrepancy was attributed to the presence of chlorinated urea in the samples, which gives a lower signal in amperometric analyses. (Geiger-FRC)
W81-00945

APPLICATION OF TWO ATTENUATION MECHANISM THEORIES TO A SANITARY LANDFILL,
Wisconsin Dept. of Natural Resources, Madison, Bureau of Solid Waste Management.
A. Bagchi, R. L. Dodge, and G. R. Mitchell.
In: Third Annual Madison Conference of Applied Research & Practice on Municipal & Industrial Waste, September 10-12, 1980, p 201-213, 1980. 8 Fig, 1 Tab, 26 Ref. University of Wisconsin-Extension, Department of Engineering & Applied Sciences, 432 N. Lake Street, Madison, WI 53706.

Descriptors: *Wisconsin, *Attenuation, *Cations, *Leachate, Monitoring, Groundwater, *Landfills, Subsoils, Surface water, Dispersion, Chlorine, Iron, Dilution, Madison area(WI).

Monitoring accuracy for testing cation exchange and dilution as attenuation mechanisms for landfill leachate is examined. Observations at points beneath and downgradient from the Dane County, Wisconsin landfill revealed a change in pH from alkaline toward a neutral value. It is difficult to draw any conclusions regarding the change, since background water quality monitoring data showed a large fluctuation of groundwater hardness through time. Calculations indicated it would take about 200 days for any contaminant to reach the nearest downgradient well. So far, a significant increase in the concentration of the parameters studied has not been observed. Further observation is needed to ensure that monitoring techniques used in the study were adequate to detect the contaminants if they are present. Recommendations for future study include additional downgradient monitoring points at depths calculated using the dispersion theory, and monitoring of upgradient water quality in the same aquifer monitored by the downgradient wells. A program is recommended for periodic leachate analysis to determine the leachate quality through time. (Garrison-Omniplan)
W81-00959

DETAILED REPORT ON THE USE OF ENZYMATIC CYCLING FOR HIGH SPECIFICITY AND PRECISION IN THE COLORIMETRIC ANALYSIS OF AMMONIA,
American Univ., Washington, DC. Dept. of Chemistry.
F. W. Carson, and H. W. Davies.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-145070, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, University of the District of Columbia, Washington, Report No 21, October, 1980. 80 p, 13 Fig, 11 Tab, 47 Ref. OWRT-B-011-DC(1).

Descriptors: *Ammonia, *Nitrogen compounds, *Analytical techniques, *Colorimetry, *Water analysis, *Methodology, Waste water(Pollution), Ammonium compounds, Ammonium salts, Analysis, Assay, Color reactions, Laboratory tests, Research and development, Testing, Testing procedures, Measurement, Calibrations, Evaluation, Estimating, Monitoring, Statistics, Technology, Waste identification.

A new method was developed for the determination of ammonium ion concentrations in water in the range of 0.0001-0.00001 molar, based upon enzymatic cycling. The sensitivity of the method could be extended well below the ten nanomoles/sample limit of determination, using suitable modifications of the procedure. This two-step method involved the use of an ammonia-specific glutamate dehydrogenase enzyme reaction with simultaneous oxidation of NADH; followed by an enzymatic cycling reaction to measure oxidized NADH by means of measuring the cycling reaction product, a tetrazolium formazan, in the visible at 600 nm. Using the procedure, linear plots of absorbance versus original ammonium ion concentration had correlation coefficients of 0.997-0.9998. The precision (coefficient of variation) of the method on replicate analyses of samples containing 0.0000441 molar ammonium ion was 2%. A calibration curve for determination of unknown ammonium concentrations could be constructed from standard solutions carried through the procedure. Analysis time per sample was three hours, and all solutions were stable for at least two weeks. (Zielinski-IPA)
W81-00987

5B. Sources Of Pollution

NITRATE FLUCTUATIONS IN GROUND WATER AS INFLUENCED BY USE OF FERTILIZER,
Connecticut Agricultural Experiment Station, New Haven.
H. C. DeRoo.
Bulletin 779, June, 1980. 13 p, 6 Fig, 8 Tab, 26 Ref.

Descriptors: *Nitrates, *Connecticut, *Groundwater, *Fertilizers, *Leachate, Tobacco, Nitrogen, Pollution, Organic compounds, Percolation, Soil types, Irrigation.

Fertilizers are often cited as sources of nitrogen in ground and surface water in suburban and rural areas. The most important nitrogen compounds found in soil solutions are ammonium and nitrate nitrogen (NO3-N). Nitrate nitrogen can be leached by heavy rain and eventually appear in ground and surface water. It is a component of the fertilizers studied on two types of terrain---farmland and suburban turf---to determine if they contribute to nitrate pollution of groundwater in the Connecticut River Valley. Groundwater under the Valley Laboratory Farm averaged 3mgL-1 nitrate nitrogen over three years, with temporary concentrations exceeding 10mgL-1 after a heavy rainfall, as observed downstream from areas treated with generous amounts of fertilizer. on the Merrell Farm in Suffield, a rural environment, there were yearround high levels of nitrate nitrogen, averaging 20mgL-1. The groundwater under suburban turf plots was not significantly influenced by moderate fertilization treatments, suggesting that the potential for nitrate leaching under turf is not significant if a reasonable N fertilizer program on lawns is followed. (Garrison-Omniplan)
W81-00754

TRANSPORT OF POTENTIAL POLLUTANTS IN RUNOFF WATER FROM LAND AREAS RECEIVING ANIMAL WASTES: A REVIEW,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. Khaleel, K. R. Reddy, and M. R. Overcash.
Water Research, Vol 14, No 5, p 421-436, May, 1980. 6 Tab, 54 Ref.

Descriptors: *Water pollution sources, *Farm wastes, *Nutrients, *Agricultural runoff, Snowmelt, Feed lots, Pastures, Ranges, Rainfall-runoff relationships, Chemical oxygen demand, Pathogenic bacteria, Path of pollutants, Ultimate disposal.

Literature on the quality of agricultural discharges from lands receiving animal wastes, the effects of climate, rates and timing of manure applications, and management practices relative to the transport of nitrogen and phosphorus nutrients, oxygen demanding compounds, and pathogens is reviewed. Pastures and rangelands where animals deposit wastes directly, croplands and other lands receiving mechanically spread animal wastes, and feedlots are considered. For lands receiving manure applications, linear regression analysis showed a highly significant correlation between nitrogen or phosphorus nutrient loading rates and both its average concentration in runoff water and its mass yield. Nutrient and COD losses were considerably higher when manure was applied on land subject to snowmelt runoff or within one day of significant rainfall. Thus higher concentrations and mass yields result from applications in spring and winter than in summer and fall. Applications of manure in solid form and as incorporated in soil result in low nutrient loss, but liquid injected application essentially eliminates pollutants in runoff. Pathogenic organisms are retained mostly at or near the soil surface, which creates great potential for surface runoff water pollution. Nutrient losses from pastures and rangelands are rarely significant and may be controlled with proper grazing schedules and by controlling erosion, sediment transport, and surface runoff. Pollutant concentrations are higher in feedlots by several orders of magnitude, with snowmelt runoff a principal factor. Future research should be directed to relating data on small plot-sized areas to larger watersheds and edge-of-field losses to receiving waters. (Just-FRC)
W81-00775

THE EFFECT OF PHYSICOCHEMICAL, PHYTOPLANKTON AND SEASONAL FACTORS ON FAECAL INDICATOR BACTERIA IN NORTHERN BRACKISH WATER,
Elainlaaketieteellinen Korkeakoulu, Helsinki (Finland).
J. Hirn, H. Vijamaa, and M. Raevuori.
Water Research, Vol 14, No 3, p 279-285, March, 1980. 5 Fig, 3 Tab, 20 Ref.

Descriptors: *Bioindicators, *Water quality, *Aquatic bacteria, *Fluctuations, *Gulfs, *Nutrients, Hydrogen ion concentration, Phytoplankton,

Sampling, Coliform bacteria, Seasonal, Brackish water, Laboratory tests, Streptococcus, Clostridium, Eutrophication, Statistical analysis, Temperature, Nitrogen, Salinity, Nitrates, Nitrites, Salmonella, Phosphorus, Finland.

Seasonal, physicochemical, and phytoplankton parameters were examined in relation to the number of coliforms, fecal coliforms, fecal streptococci, and Clostridium perfringens at several stations in the brackish waters of the Gulf of Finland. The study period lasted for 1 year, over which seasonal changes in the fecal indicator bacteria were noted. A significant correlation was found among the various species of non spore-forming fecal indicator bacteria investigated. Temperature and pH were found to have a marked effect on the number of fecal indicator bacteria. Some nutrients, especially total nitrogen and nitrate nitrogen, also played a role in influencing the number of fecal indicator bacteria present. The lack of correlation between C. perfringens and the other indicator bacteria was attributed to changes in pH values. It was concluded that C. perfringens would be useful as an indicator organism in ecosystems containing many stress factors. Since stress factors may affect the number of fecal indicator bacteria present, it was advised that the quality of water be evaluated using several parameters. (Geiger-FRC)
W81-00792

OCCURRENCE OF SULPHATE REDUCING BACTERIA IN THE HUMAN INTESTINAL FLORA AND IN THE AQUATIC ENVIRONMENT,
Institut Pasteur, Paris (France). Domine du Certia.
H. Leclerc, C. Oger, H. Beerens, and D. A. A. Mossel.
Water Research, Vol 14, No 3, p 253-256, March, 1980. 3 Fig, 3 Tab, 14 Ref.

Descriptors: *Enteric bacteria, *Water pollution, *Sewage treatment, *Sulfur bacteria, *Bioindicators, E. coli, River waters, Potable water, Secondary treatment, Sewage sludge, Sewage bacteria, Activated sludge, Cultures, Sampling, Laboratory tests, Chlorination, Monitoring.

A total of 609 samples of water, sludge, and human stools was examined for the presence of sufate-reducing bacteria. A random choice of 325 of these samples was studied for the presence of E. coli. Of the water samples, 220 were from tap water, 45 from rivers, 61 from influents, 30 from primary sewage effluent, 65 from secondary sewage effluent, and 45 from activated sludge. Sulfate reducing bacteria were detected at a mean rate of 1,000,000/100 g of feces, 1,000,000/100 ml of crude sewage, 100,000/100 ml of river water and about 100/100 ml of tap water. Some similarities were found in distribution curves of sulfate-reducing bacteria and E. coli in some types of water. The occurrence of sulfate-reducing bacteria at high levels in various types of water suggests their fecal origin. However, the high resistance of sulfate reducing bacteria to extraenteric conditions and the complicated techniques required for their detection make them inappropriate as indicator organisms for routine environmental pollution monitoring. (Geiger-FRC)
W81-00793

STREAM-WATERSHED RELATIONSHIPS IN THE MISSOURI OZARK PLATEAU PROVINCE,
Missouri Univ.-Columbia.
For primary bibliographic entry see Field 4C.
W81-00803

DEVELOPMENT OF MODELS TO PREDICT QUALITY OF RUNOFF WATER FROM AGRICULTURAL WATERSHEDS,
Tennessee Univ., Knoxville.
C. H. Shelton, and G. M. Lessman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-143380, Price codes: A03 in paper copy, A01 in microfiche. Tennessee Water Resources Research Center, University of Tennessee, Research Report No 77, September, 1980. 35 p, 6 Fig, 11 Tab, 11 Ref. OWRT A-047-TENN(1).

Descriptors: *Model studies, *Agricultural runoff, Forecasting, *Water quality, *Sediment yield, Nutrients, Metals, Sewage sludge, Agricultural practices, Runoff, Coliforms, Groundwater, Aricultural watersheds.

Municipal sewage sludge following primary sedimentation was applied on a 3.7-ha watershed during four winter months of 1976, 1977, and 1978 at rates of 20.8, 25.7 and 25.2 t/ha (dry weight), respectively. Samples of the sludge, surface runoff, groundwater, soil, and corn leaves were analyzed for selected nutrients and metals. Concentrations of metals and nutrients in runoff were generally low and constant throughout the sampling period. Infrequent high concentrations of nutrients and metals, as well as fecal coliform count, were attributed to runoff occurring soon after applications of sludge when little or no vegetation was present. Concentrations of metals in groundwater sampled in the third year of sludge applications generally showed no increase over those in surface runoff. Data used for generation and testing of regression equations to predict sediment yield were obtained from a total of 145 runoff events on four small (3.7-80.4 ha) agricultural watersheds during the period 1974-1979. Attempts were made to modify the universal soil loss equation by inserting various combinations of watershed and climatic variables to describe conveyance and antecedent conditions. A stepwise linear regression of variables after logarithmic transformation accounted for more variation in sediment yield on two watersheds than other forms of equations attempted. Due to major differences in land use, however, a separate sediment-yield prediction equation was required for each of the four watersheds.
W81-00805

ANALYSES OF WATER AND DREDGED MATERIAL FROM SELECTED SOUTHERN LOUISIANA WATERWAYS AND SELECTED AREAS IN THE GULF OF MEXICO, 1976-78,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-00836

CATCHMENT QUALITY CONTROL,
Thames Water Authority, London (England). Directorate of Scientific Services.
For primary bibliographic entry see Field 5G.
W81-00854

TOXIC SUBSTANCES FROM FRESHWATER ALGAE,
Alberta Univ., Edmonton. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W81-00855

WELL WATER QUALITY ON MOEN ISLAND, TRUK,
Guam Univ., Agana. Water Resources Research Center.
For primary bibliographic entry see Field 5G.
W81-00866

MICROBIOLOGICAL EVALUATION OF COASTAL WATERS QUALITY IN THE TYRRHENIAN SEA,
Genoa Univ. (Italy). Inst. of Hygiene.
F. L. Petrilli, G. P. De Renzi, P. Orlando, and S. De Flora.
Progress in Water Technology, Vol 12, No 1, p 129-136, 1980. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Sea water, *E. coli, *Streptococcus, *Viruses, *Coliforms, *Sewage bacteria, Tyrrhenian Sea, Microbiology, Water quality, Beaches, Coasts, Public health, Europe.

The microbiological quality of coastal waters in the Tyrrhenian Sea was evaluated in a four year study. Animal viruses were concentrated from sea water samples and sediments by adsorption of insoluble polyelectrolytes. Total coliforms were detected using the multiple tube fermentation test. Fecal streptococci were detected using the membrane filter method. Isolated viruses included types 1, 2, and 3 poliovirus, echovirus, one strain of reovirus, and unidentified enteroviruses. The virus titer ranged from 0.6 to 16 TCD50 per 100 ml of surface sea water, from 0.2 to 1.2 for bottom water, and from 4 to 40 for sediment eluates. The bacteriological load of the pollution in the area was highly variable. Most bathing areas were below 100 E. coli in 100 ml sea water, a limit set by Italian sanitary authorities. A positive correlation was found between total coliforms and E. coli, between total coliforms and fecal streptococci, and between E. coli and fecal streptococci. A significant positive correlation was also found between the numbers of E. coli and enteroviruses. The terminal tracts of two rivers, the Calambrone and the Cecina, were included in the coastline studied. The Cecina river, which receives a number of sewage effluents, was highly polluted, while the pollution load introduced by the Calambrone river was relatively low. (Small-FRC)
W81-00887

SANITARY AND AESTHETIC QUALITY OF THE COASTAL WATERS OF SPAIN,
Ministry of Public Health and Social Security, Madrid (Spain).
R. Mujeriego, and B. Sanchez Murias.
Progress in Water Technology, Vol 12, No 1, p 119-127, 1980. 6 Tab, 6 Ref.

Descriptors: *Sea water, *Coliforms, *Sewage bacteria, *Epidemiology, *Morbidity, Water quality, Beaches, Europe, Public Health, Mathematical studies, Spain.

The degree of pollution at the beaches and coastal areas of Spain was evaluated during the summers of 1977 and 1978. Microbiological water quality was recorded at selected beaches, and standardized epidemiological studies were carried out among people using the beaches. The multiple dilution technque was used to determine total coliform and fecal coliform concentrations in sea water. Approximately 15 to 30% of the areas studied could not be considered microbiologically satisfactory according to national and international water quality standards. The eidemiological study utilized 16,693 valid questionaires from 10 coastal provinces. No statistically significant correlation was found between morbidity rates for skin eruptions, or eye, ear, and nose infections and local sea water quality expressed in terms of total coliforms. There was a significant correlation between morbidity rates for mycosis and total coliform concentrations. (Small-FRC)
W81-00888

PRELIMINARY ESTIMATE OF MERCURY POLLUTION IN THE FRENCH MEDITERRANEAN (PROVENCE-COTE D'AZUR) BY STUDYING CONTAMINATION LEVELS IN SEDIMENTS AND BENTHIC ORGANISMS (PREMIERE ESTIMATION DE LA POLLUTION MERCURIELLE DU LITTORAL MEDITERRANEEN FRANCAIS (PROVENCE-COTE D'AZUR) PAR L'ETUDE DU DEGRE DE CONTAMINATION DES SEDIMENTS ET DES ORGANISMS BENTHIQUES),
Centre Universitaire de Luminy, Marseille (France).
For primary bibliographic entry see Field 5A.
W81-00890

DISTRIBUTION OF HEAVY METALS IN THE SUPERFICIAL MARINE SEDIMENTS IN THE VICINITY OF THE RHONE MOUTHS,
Nice Univ. (France). Lab. de Sedimentolgie.
A. Added, F. Fernex, and F. Rapin.
Progress in Water Technology, Vol 12, No 1, p 89-96, 1980. 8 Fig, 11 Ref.

Descriptors: *Sea water, *Sediments, *Rivers, *Heavy metals, Water pollution, Mercury, Lead, Cobalt, Nickel, Zinc, Cadmium, Spectrophotometry, Copper, France, Rhone River, Transport, *Path of pollutants.

The transport of heavy metals to the sea by the Rhone River was investigated by analysis of sur-

face marine sediments within 20-30 km of the mouth of the river. The sediment samples were passed through a 63 micron sieve, and atomic absorption spectrophotometry was performed, followed by extraction in concentrated nitric-perchloric acid. The highest concentrations of metals were found near the river's mouth, with the exception of mercury, which was also high in the Golfe of Fos region. Concentrations in mg/kg were: 31-145 for Pb, 1-14 for Co, 13-32 for Ni, 70-160 for Zn, 18-50 for Cu, 0.14-1.5 for Cd, and 0.08-1.93 for Hg. This first phase of the analysis of results includes concentration contour maps. (Small-FRC)
W81-00893

PROBLEMS OF STORAGE OF VARIOUS SUBSTANCES FOUND IN THE INTERSTITIAL WATERS OF THE SURFACE SEDIMENTS OF THE FRENCH CONTINENTAL SHELF,
Station Marine, Villefranche-sur-Mer (France). Laboratoire Geodynamique Sous-marine.
C. Bagliniere, J. Cenciarini, F. Fernex, R. Pucci, and R. Vaissiere.
Progress in Water Technology, Vol 12, No 1, p 79-87, 1980. 7 Fig, 17 Ref.

Descriptors: *Sediments, *Sea water, *Nutrients, *Surfactants, Detergents, Ammonium compounds, Ions, Water pollution, Europe, Mediterranean, Cote d'Azur, Continental shelf, France.

The concentrations of a number of substances or ions existing in dissolved form in interstitial waters of superficial sediments of the continental shelf of the Cote d'Azur were determined. These substances include nutrients and anionic surfactants. Conentrations varied with region and time of year. For example, in November 1978, following a long period of good weather, the ammonium concentrations were very high in the superficial sediments of the Bay of Nice, reaching 1000 micrograms/liter. In January, the concentrations decreased as much as 100 times. There were no clear correlations between the various parameters studied. Thus, there were opportunities for dissolved nutrients, detergents, etc. stored in the interstitial waters to be liberated into the sea water, but the reasons for variations in rate of liberation are not yet known. The concentrations of anionic surfactants found in the Nice region were surprisingly low; this may be due to efficient waste water purification by this municipal system or to rapid biodegradation. (Small-FRC)
W81-00894

DISPERSANTS FOR ELIMINATING OIL SPILLS (AGENTES DISPERSANTES PARA ELIMINAR DERRAMES DE PETROLEO),
Carretera de Valldemosa, Palma de Mallorca (Spain). Dept. of Chemical Engineering.
M. Estrades, and J. R. Bergueiro.
Progress in Water Technology, Vol 12, No 1, p 35-48, 1980. 4 Tab, 6 Ref.

Descriptors: *Dispersion, *Sea water, *Oil, *Oil pollution, Water pollution, treatment, Oil spills, Salinity, Laboratory tests, Mixing, Surfactants, Non-ionic dispersants.

Experiments revealed that the dispersion of crude oil in sea water is influenced more by the velocity of agitation than by the dispersant/crude oil ratio. A non-ionic dispersant, Renex 690, and a Kiruk-type crude oil were used in sea water with a saline level greater than 5 g/liter. Changes in the concentration of crude oil in the sea water relative to the duration and velocity of agitation were determined. Optimum dispersion was obtained by stirring at 4000 rev/min. The optimum dispersant/oil ratio was 0.35 g. Regression analysis with 90% confidence limit indicated a 3% deviation from the mean with 15% dispersion. (Small-FRC)
W81-00896

BASELINE LEVELS OF HEAVY METALS IN THE WATERS AND SEDIMENTS OF BAFFIN BAY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
J. A. Campbell, and D. H. Loring.
Marine Pollution Bulletin, Vol 11, No 9, p 257-261, September, 1980. 1 Fig, 3 Tab, 22 Ref.

Descriptors: *Heavy metals, *Sea water, *Sediments, *Bays, Spectrophotometry, Iron, Manganese, Baffin Bay, Greenland, Cadmium, Chromium, Cobalt, Copper, Zinc, Mercury, Nickel, Baseline studies.

Baseline trace metal studies of both the waters and sediments of Baffin Bay, Greenland, were performed. Samples from the principal water fluxes and deep bay water were analyzed by flameless atomic absorption spectrometry following chelation (solvent extraction or ion exchange techniques). Sediment samples were obtained at water depths from 93 to 2320 m and sedimentological and chemical analyses were carried out. Concentrations of Cr, Mn, Fe, Ni, Cu, and Cd in water samples were generally lower than those observed in eastern Canadian coastal waters. Levels were close to those found in open ocean samples. Near shore sediment samples had comparable concentrations of Cr, V, Mn, Ni, Co, Cu, Zn, Hg, and Pb to unpolluted muds in eastern Canadian coastal regions. Concentrations of these elements in deep water sediments closely resembled levels in Atlantic Ocean deep-sea clays. (Small-FRC)
W81-00905

METHYLATION OF LEAD IN MARINE SEDIMENTS,
Institute of Ocean Sciences, Sidney (British Columbia). Ocean Chemistry Div.
J. A. J. Thompson, and J. A. Crerar.
Marine Pollution Bulletin, Vol 11, No 9, p 251-253, September, 1980.

Descriptors: *Sediments, *Lead, Mine wastes, Fjords, Coasts, Methane bacteria, Water pollution sources, Canada, British Columbia, Methylation, Aquatic microbiology.

Sediments were collected from a northern British Columbia fjord, Alice Arm, and three other coastal locations, to study the possible release of lead from mine tailings deposited in Alice Arm. The comparative abilities of the four sediments to support biologically mediated methylation of lead added in three chemical forms were determined. Lead as Pb(OAc)2 was not methylated under the experimental condition used. About 0.03% of lead as Pb(NO3)2 underwent methylation. Tetravalent lead, as (CH3)3PbOAc, was methylated almost completely. However, it is unlikely that (CH3)3PbOAc would be present under natural conditions. The sediments from the four locations showed little variation in methylating capacity, and there was no relationship between methylating capacity and the total ambient lead concentration. The lead contained in the mine tailings was not mobilized in detectable amounts. Thus, the lead in the samples was mostly unavailable to biological processes. (Small-FRC)
W81-00906

LABORATORY STUDIES ON THE ADSORPTION OF ACRYLAMIDE MONOMER BY SLUDGE, SEDIMENTS, CLAYS, PEAT AND SYNTHETIC RESINS,
Plymouth Polytechnic (England). John Graymore Chemical Labs.
L. Brown, K. C. C. Bancroft, and M. M. Rhead.
Water Research, Vol 14, No 7, p 779-781, July, 1980. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Adsorption, *Resins, Clays, Sediments, Sludge, Peat, Plastics, Waste water treatment, Toxins, Hydrogen ion concentration, Rivers, Chemical degradation, Acrylamide, Organic compounds.

The polyacrylamides are often contaminated by the highly toxic acrylamide monomer during their manufacture. Polymers are used extensively in water treatment processes; standards limit the level of acrylamide in potable water to 0.25 micrograms/liter. Long term analysis of the adsorption of acrylamide by sludges under environmental conditions has been hindered by the rapid degradation of the acrylamide monomer in non-sterile environments. The removal of acrylamide monomer from the water column by adsorption onto sludge, peat, and sediment particles was examined in short-term experiments. No significant adsorption of acrylamide monomer was found. Other studies showed that no acrylamide was rmoved from sterilized river water by clays and anionic, cationic or hydrophobic resins at various concentrations and pH levels tested. A limited affinity for acrylamide was found in activated carbon, which was not affected by pH in the range investigated. (Geiger-FRC)
W81-00924

MODEL STUDIES OF THE DEGRADATION OF ACRYLAMIDE MONOMER.
Plymouth Polytechnic (England). John Graymore Chemical Labs.
L. Brown, M. M. Rhead, K. C. C. Bancroft, and N. Allen.
Water Research, Vol 14, No 7, p 775-778, July, 1980. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Organic compounds, *Microbial degradation, *Model studies, *Plastics, Biodegradation, Anaerobic bacteria, Aerobic bacteria, Photosynthetic bacteria, Waste water disposal, Sampling, Acrylamides.

Factors which are likley to affect the residence time of acrylamide in natural and polluted waters are discussed. Acrylamide degraded in all unsterilized natural and polluted water samples studied. The major cause of acrylamide loss from spiked water samples was microbial degradation. The ability to degrade the chemical is widespread among natural bacterial stocks found in river, estuarine and sea water samples. In situations where light is available the major decomposers will be photosynthetic, while nonphotosynthetic bacteria predominate in darker regions. Light did not significantly alter the degradation of acrylamide; however, degradation did occur more rapidly in light than in dark after deaeration. This suggests that certain nonphotosynthetic aerobic and photosynthetic and nonphotosynthetic anaerobic bacteria in the samples tested had the capability to degrade acrylamide. Sterile samples of tap water taken at Plymouth showed no chemical degradation occurring over 2000 hr. It is suggested that the industrial addition of strong acids, bases, oxidizing or reducing agents to process waste waters may aid in degrading acrylamide. (Baker-FRC)
W81-00925

VIRUS INTERACTIONS WITH SOIL COMPONENTS: MEASUREMENTS AND USE FOR PREDICTING MOVEMENT DURING LAND APPLICATION OF MUNICIPAL WASTEWATER,
California Univ., Los Angeles. Dept. of Chemical, Nuclear and Thermal Engineering.
V. L. Vilker.
In: Third Annual Madison Conference of Applied Research & Practice on Municipal & Industrial Waste, September 10-12, 1980, p 34-53, 1980. 12 Fig, 22 Ref. University of Wisconsin - Extension, Department of Engineering & Applied Sciences, 432 N. Lake Street, Madison, WI 53706.

Descriptors: *Viruses, *Waste water disposal, *Sands, *Clays, *Adsorption, Sorption, Percolation, Sewage, Effluent, Attenuation, Filtration, Soils, Electron microscopy, Entrapment.

Growing interest in various forms of water reuse, and an increased awareness concerning public health aspects of wastewater disposal, require better understanding of the fate of human pathogens contained in domestic raw sewage. Studies on the fate of viruses in soil-water environments and recent research on the specific interactions of attenuated poliovirus I with sand and clay are summarized. The results concerning sand indicate that adsorption sites occupy about 1.5% of the total sand particle surface area. There is also indication that the adsorption reaction of polio to sand is weak. The clay interaction was examined both optically and with electron microscopy which gave reasonable assurance that poliovirus is removed from clay suspensions of batch equilibrium experiments by the adsorption mechanism. The

poliovirus preparations and the batch adsorption mechanism suspensions were of the same composition in both the sand and clay studies. Further study of the movement of poliovirus through laboratory packed beds of sand and sand/clay mixtures, to assure that clay aggregation effects are absent or minimized, would be desirable. (Garrison-Omniplan)
W81-00930

A MODEL PROVISION FOR NON-DEGRADATION OF GROUNDWATER: WHAT IS A DETRIMENTAL EFFECT AND WHERE IS IT MEASURED,
Wisconsin Univ.-Oshkosh. Coll. of Letters and Science.
For primary bibliographic entry see Field 5A.
W81-00935

OZONE-INDUCED BIODEGRADABILITY OF A NON-IONIC SURFACTANT,
Environmental and Water Resources Engineering, Haifa (Israel).
N. Narkis, and M. Schneider-Rotel.
Water Research, Vol 14, No 9, p 1225-1232, September, 1980. 6 Fig, 2 Tab, 24 Ref.

Descriptors: *Ozone, *Surfactants, *Waste water treatment, *Chemical oxygen demand, *Biodegradation, Ultraviolet radiation, Organic wastes, Sewage effluents, Biological treatment, Molecular structure, Waste treatment, Separation techniques.

The OECD (Organization for Economic Cooperation and Development) screening test for biodegradability was modified to test the ozone-induced biodegradability of a non-ionic surfactant, branched chain nonyl phenol ethoxylate. Ozonized solutions and blanks were seeded with 1 ppm filtered sewage treatment plant effluent, shielded from light and placed in shaking devices at 25 degrees. Samples were drawn and analyzed at different time periods for COD and TOC (total organic carbon) levels and changes in UV spectrum adsorption. Results showed that the efficiency of removal of non-ionic surfactants increased with increasing ozone doses. Biodegradation after ozonation resulted in overall removals of 70% COD and 62.5% of the TOC as compared with an 8 to 25% removal of COD and a 23% removal of TOC with biodegradation of the non-ozonized non-ionic surfactant. The enhanced biodegradability in ozonated preparations was attributed to changes in molecular structure of the non-ionic surfactant which were demonstrated in its UV spectrum and its chemical reaction with ammonium cobaltothiocyanate. (Geiger-FRC)
W81-00940

VARIATIONS IN WATER QUALITY DURING WINTER IN TWO YUKON RIVERS WITH EMPHASIS ON DISSOLVED OXYGEN CONCENTRATION,
British Columbia Univ., Vancouver. Dept. of Soil Science.
H. Schreier, W. Erlebach, and L. Albright.
Water Research, Vol 14, No 9, p 1345-1351, September, 1980. 9 Fig, 2 Tab, 7 Ref.

Descriptors: *Rivers, *Dissolved oxygen, *Water quality, *Seasonal, *Ice cover, *Alaska, Sampling, Monitoring, Environmental effects, Trace metals, Nutrients, Fluctuations, Groundwater, Aeration, Alcan pipeline.

In view of the increasing development of energy sources in the Arctic and the lack of information on the baseline water quality of the rivers of this area, some winter variations in water quality were studied in an arctic and subarctic river basin in the Yukon Territory. This project was undertaken as part of the environmental impact analysis program for the Alcan pipeline conducted by the Department of the Environment, Inland Waters Directorate. The Swift River of the Southern Yukon and the Ogilvie River in the Northern Yukon Territory were sampled over a one year period for dissolved oxygen (DO), minerals, selected trace metals, nutrients, nitrogen, organic components, pH, and specific conductance. Depressions in DO were noted in both rivers during the winter when ice cover was present. In late winter, DO levels were the lowest while concentrations of basic cations were at a maximum. No relationships were found between oxygen levels and ice thickness or type. More groundwater low in DO was present as winter progressed and ice cover offered little chance for aeration. Other contributing factors to the low DO were oxygen uptake by suspended solids and by biota. These results support other studies showing low DO levels in Alaskan environments in the late winter. (Geiger-FRC)
W81-00943

RAIN WATER LEACHATES OF HEAVY METALS IN ROAD SURFACE SEDIMENTS,
Middlesex Polytechnic, London (England).
D. M. Revitt, and J. B. Ellis.
Water Research, Vol 14, No 10, p 1403-1407, October, 1980. 2 Fig, 1 Tab, 16 Ref.

Descriptors: *Leaching, *Heavy metals, *Surface runoff, *Water pollution sources, *Drainage water, Storm water, Paving, Cadmium, Lead, Manganese, Toxicity, Particle size, Benthos, Sediments, Storm drains, Construction materials.

It has been shown that certain street surface sediments can contribute to the heavy metal pollution of stormwater drainage systems. The extractabilities of heavy metals from London street particles of different sizes were compared under simulated storm water flow conditions. Samples of street surface and roadside gutter sediments of separate catchment areas were examined for heavy metal leachability using rainwater of pH 6.5. Levels of Pb, Cd and Mn were determined by atomic absorption spectrophotometry in sediment preparations removed from rainwater after 1, 5, 11, 15, or 28 days. Solubility curves varied with time. Results of sorption and desorption experiments showed that Cd tended to desorb more rapidly from fractions with grain sizes greater than 250 micrometers. Heavy metal leachate patterns in areas of high and low motor vehicle traffic showed no significant differences. The overall extraction efficiency of Cd was found to be 10 times that of Mn which was, in turn, 100 times that of Pb. Mn showed the greatest potential for attaining equilibrium in rainwater samples. Under heavy storm conditions, enrichment of heavy metals through leaching from street pavings might cause toxic effects on benthic organisms. (Geiger-FRC)
W81-00950

APPLICATION OF TWO ATTENUATION MECHANISM THEORIES TO A SANITARY LANDFILL,
Wisconsin Dept. of Natural Resources, Madison, Bureau of Solid Waste Management.
For primary bibliographic entry see Field 5A.
W81-00959

CONTAMINATION OF FRESH WATER AQUIFERS BY OIL SPILLS,
Department of Energy, Morgantown, WV. Morgantown Energy Technology Center.
K. I. Kamath, J. Pasini, and B. J. Kush.
In: Third Annual Madison Conference of Applied Research & Practice on Municipal & Industrial Waste, September 10-12, 1980, p 174-186. 4 Fig, 3 Ref. University of Wisconsin-Extension, Department of Engineering & Applied Sciences, 432 N. Lake Street, Madison, WI 53706.

Descriptors: *Contamination(Water), *Oil pollution, *Oily water, *Fluid flow, *Aquifers, Well drilling, Groundwater, Reservoirs(Oil), Water quality, Flow rates, Darcys Law.

The flow and distribution of spilled water-immiscible liquids within sand and gravel aquifers is discussed on the basis of the theory of multi-phase fluid flow through porous media and water well hydraulics. In an aquifer fully saturated with water, the flow is homogeneous or 'single-phase.' Air in the strata with the water is described as a 'two-phase' flow. The water can also be associated with immiscible or partially miscible liquid instead of air, thus altering the flow and posing potential water quality problems. Fluid flow sufficiently contaminated with oil can be in two distinct stages. In Stage I, the oil saturation at the contaminated section of the aquifer is above its residual value. Invasion by air of an oil-contaminated aquifer with a stabilized residual oil saturation represents Stage II. An oil spill will ultimately result in the dispersion of the oil into the aquifer pore systems as a 'residual' immobile phase, possibly modified by gravity effects. Aquifer contamination by buried 'oil wastes' is a serious problem and the damage may be irreversible. The problem of decontamination of an aquifer after an oil spill is nearly identical to that of the tertiary recovery of crude oil, but with even more constraints. Tertiary oil recovery also poses potential contamination situations. There are few practical inexpensive means to decontaminate affected aquifers except by drilling emergency wells to apply solvents or other fluids to the spill to recover and dispose of the contaminats. There is a need for preventive rather than curative methods for oil spill control. (Atkins-Omniplan)
W81-00963

THE NATURE AND EFFECTS OF COUNTY DRAINAGE DITCHES IN SOUTH CENTRAL MINNESOTA,
Mankato State Univ., MN. Dept. of Biological Sciences.
For primary bibliographic entry see Field 4A.
W81-00976

STREAM-WATERSHED RELATIONS IN THE MISSOURI OZARK PLATEAU PROVINCE,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
For primary bibliographic entry see Field 4C.
W81-00978

UNDERGROUND RESIDENCE TIMES AND CHEMICAL QUALITY OF BASAL GROUND WATER IN PEARL HARBOR AND HONOLULU AQUIFERS, OAHU, HAWAII,
Hawaii Univ., Honolulu.
T. H. Hufen, P. Eyre, and W. McConachie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-135444, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, Honolulu, University of Hawaii, Technical Report 129, February, 1980. 83 p, 1 Fig, 1 Tab, 24 Ref, 1 Append. 14-31-0001-3811.

Descriptors: *Hawaii, *Water pollution control, *Groundwater resources, *Aquifer management, *Aquifer testing, *Isotope studies, Time of concentration, Chemical analysis, Oil spills, Subsurface waters, Radioactive waste disposal, Underground storage, Contamination(Water), Organic compounds.

The deterioration in chemical quality of basal water with underlying saline water is of utmost concern on Oahu, where the Pearl Harbor and Honolulu groundwater systems constitute a primary source of fresh water. This study uses isotope and chemical analyses to investigate the storage and flow of the systems of six areas in southern Oahu. Potential origins of waters were determined by using mixing models and chemical compositions of water samples from sources located within a few miles of each other. Striking differences were found among the six areas; for example, underground residence times of basal waters in the Kalihi, Beretania and Moiliili systems are quite long in comparison to residence times of other systems. However, basal water in the Waialae system has a comparatively short residence time within the Honolulu systems. Many regions show the presence of transition-zone water, return irrigation water or caprock-type water, either singularly or in some combination. The study recommends preventive measures be taken to minimize the possible deterioration of Pearl Harbor basal water due to infiltration of manmade substances such as petroleum products or dangerous radioactive substances. The effect of agricultural activity on the chemical quality of Pearl Harbor basal water also needs further study. (Garrison-Omniplan)

W81-00982

5C. Effects Of Pollution

DIEL PATTERNS OF ICHTHYOPLANKTON LENGTH-DENSITY RELATIONSHIPS IN UPPER WATTS BAR RESERVOIR, TENNESSEE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
G. F. Cada, J. M. Loar, and K. D. Kumar.
In: Proceedings of the Fourth Annual Larval Fish Conference, February 27-28, 1980, Oxford, Mississippi, Fuiman, L. A., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/43, September, 1980, p 79-90. 4 Fig, 1 Tab, 9 Ref. W-7405-eng-26.

Descriptors: *Plankton, *Fish, *Larvae, *Sampling, Diel migration, Reservoirs, Fish populations, Fish behavior, Diurnal distribution, Vertical migration, Growth stages, Tennessee, Aquatic drift, Clupeids, *Bar Reservoir(TN).

Diel changes in drift rates bias the results of ichthyoplankton field studies which are restricted to day or night sampling, and these changes must be accounted for in investigations of fish populations or in assessment of water-use impacts. A diel ichthyoplankton sampling program was conducted in upper Watts Bar Reservoir, Tennessee, during 1978 to obtain information on diel changes in abundance of fish larvae in the planktonic drift and the extent of visually mediated sampling gear avoidance by motile larvae. Two-way analysis of variance tests revealed few significant diel differences in densities of individual taxa but showed consistently significant diel differences in mean total lengths of fish larvae. Clupeids in the 5 to 18 mm total length range were more abundant in surface samples during the day than during the night. Clupeid larvae either smaller or larger were relatively more abundant during the night. The greater nocturnal densities of larger larvae may be due to the inhibition of visual gear avoidance during the night. Although no direct evidence is available, diel vertical migration may also influence the observed patterns in size-specific, day-night density ratios. (Moore-SRC)
W81-00761

DETERMINATION OF THE VERTICAL DISTRIBUTION OF ICHTHYOPLANKTON IN LAKE NORMAN, NORTH CAROLINA, USING A DISCRETE-DEPTH SAMPLING DESIGN,
Duke Power Environmental Sciences Unit, Huntersville, NC.
R. E. Lewis, and J. R. Siler.
In: Proceedings of the Fourth Annual Larval Fish Conference, February 27-28, 1980, Oxford, Mississippi, Fuiman, L.A., Ed., Fish and Wildlife Service, Office of Biological Service, Report FWS/OBS-80/43, September, 1980, p 91-100. 3 Fig, 4 Tab, 9 Ref.

Descriptors: *Depth, *Sampling, *Larvae, *Fish, *Plankton, Spatial distribution, Lakes, Water temperature, Dissolved oxygen, North Carolina, Nuclear powerplants, Growth stages, Vertical distribution, Perches, Shad, Crappie, *Lake Norman(NC).

A vertical distribution study of larval shad, crappie, and percids in Lake Norman, North Carolina, was initiated in 1977 to: determine vertical distribution of ichthyoplankton in the vicinity of the McGuire Nuclear Station discharge during preoperational and operational periods; compare vertical distribution with water temperature, dissolved oxygen concentration, and total length of individuals in each taxon; and address the suitablity of a discrete depth sampling design in meeting these objectives. Vertical distribtuion varied with length of individuals in each taxon and water temperature, but dissolved oxygen concentration did not appear to influence the vertical distribution. The discrete-depth sampling design, using 2.5 m depth increments, was adequate for comparing vertical distribution of larval fishes with physical variables. Although a precise estimate of larval fish density for the complete water column was not possible, changes in vertical distribution of ichthyoplankton were detected. (Moore-SRC)
W81-00762

DIEL, VERTICAL AND HORIZONTAL VARIATIONS IN ABUNDANCE OF LARVAL DOROSOMA SPP. IN CENTER HILL RESERVOIR, TENNESSEE,
Tennessee Cooperative Fishery Research Unit, Cookeville.
M. J. Van Den Avyle, and D. D. Fox.
In: Proceedings of the Fourth Annual Larval Fish Conference, February 27-28, 1980, Oxford, Mississippi, Fuiman, L.A., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/43, September, 1980, p 116-122. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Distribution, *Larvae, *Fish behavior, *Fish, Tennessee, Spatial distribution, Temporal distribution, Shad, Sampling, Reservoirs, *Center Hill Reservoir(TN).

Knowledge of spatial and diel variations in abundance of larval fishes is important for understanding fish behavior and for developing efficient sampling programs. Larval Dorosoma species were collected at five depths from one midchannel station and from the surface at two inshore stations during May and June 1979. Collections were made six times during each of three 24 hour periods. Catches were highest at night and lowest at midday, and the larvae were always most abundant in the surface or 2 m samples. Diel variations are believed to result primarily from changes in catchability rather than vertical migrations. Midchannel densities were lower than shoreline or nearshore densities during two of the three sampling periods. Median lengths of shad larvae showed no consistent vertical or diel patterns, but specimens collected along the shoreline were usually shorter than those collected at the midchannel station. (Moore-SRC)
W81-00763

SEASONAL OCCURRENCE, DISTRIBUTION, AND POWER PLANT ENTRAINMENT OF LARVAL FISHES IN PRESQUE ISLE HARBOR, LAKE SUPERIOR,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
J. T. Hatch.
In: Proceedings of the Fourth Annual Larval Fish Conference, February 27-28, 1980, Oxford, Mississippi, Fuiman, L.A., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/43, September, 1980, p 123-135. 4 Fig, 3 Tab, 24 Ref.

Descriptors: *Lake Superior, *Entrainment, *Fish, *Larvae, *Distribution, Michigan, Powerplants, Plankton, Seasonal, Temporal distribution, Spatial distribution, Fish reproduction, Fish behavior, Limnology, Sculpins, Cisco, Smelts, Lake trout, Suckers, Perches.

As part of a study to assess effects of expansion and operation of the Presque Isle Power Station, Marquette, Michigan, on the aquatic biota of Presque Isle Harbor, Lake Superior, ichthyoplankton were collected from April 1975 through July 1976. Larval fishes were found in the harbor during all months except September, October, and November. Larvae of most taxa appeared only between April and August, but coregonines and fourhorn sculpin occurred from December to July, and December to June, respectively. In 1976, coregonines and fourhorn sculpin reached peak abundance about mid-May, followed by rainbow smelt in late May, lake trout and white sucker in early June, yellow perch in mid-June, burbot in late June, sculpins of the genus Cottus in mid-July, and ninespine stickleback in late July. Larvae of most taxa exhibited clumped distributions during their respective periods of peak abundance. total entrainment from August 1975 through 1976 was estimated at 8,800,000 larvae. Rainbow smelt, coregonines, fourhorn sculpin, and lake trout accounted for 92.8%, 3.4%, 1.5%, and 1.2% of this estimate, respectively. Entrainment appeared to be associated with seasonal succession of larvae, behavioral characteristics of larvae, and physical factors such as river discharge, harbor circulation, and wave action. (Moore-SRC)
W81-00764

COPPER PHARMACOKINETICS IN FISH GILLS-II. BODY SIZE RELATIONSHIPS FOR ACCUMULATION AND TOLERANCE,
Concordia Univ., Montreal (Quebec). Dept. of Biological Sciences.
P. D. Anderson, and P. A. Spear.
Water Research, Vol 14, No 8, p 1107-1111, August, 1980. 2 Fig, 4 Tab, 25 Ref.

Descriptors: *Fish, *Copper, *Kinetics, *Lethal limit, Rainbow trout, Sunfish, Metals, Chemical analysis, Bioassay, Water quality.

Lethal tolerance levels to copper were determined for two species of fish: a warm-water species, pumpkinseed sunfish (Lepomis gibbosus), and a cold water species, rainbow trout (Salmo gairdneri). The LC50 for sunfish increased disproportionately with body weight and varied as the reciprocal of copper accumulation rate in the gills. Thus, smaller sunfish accumulated copper at a greater rate, receiving a larger dosage per unit body weight, and were less tolerant to copper. In contrast, the body weight of rainbow trout had no effect on the LC50 and the accumulation rate of copper. It is suggested that a causal relationship exists between the amount of copper accumulated in gills and the lethal tolerance to copper. A comparison is made between the results of this study and other findings published on lethal tolerance levels. (McKeon-FRC)
W81-00768

HETEROTROPHIC BACTERIA IN TWO CANADIAN RIVERS-I. SEASONAL VARIATIONS IN THE PREDOMINANT BACTERIAL POPULATIONS,
New Brunswick Univ., Fredericton. Microbiology Research Lab.
C. R. Bell, M. A. Holder-Franklin, and M. Franklin.
Water Research, Vol 14, No 5, p 449-460, May, 1980. 8 Fig, 7 Tab, 55 Ref.

Descriptors: *Rivers, *Populations, *Nutrients, *Seasonal, *Aquatic bacteria, Water quality, Canada, Eutrophication, Monitoring, Chlorophyll, Photosyntheses, Fluctuations, Pseudomonas, Nitrogen fixing bacteria, Ice cover, Oligotrophy, Aquatic populations, Surface waters, Dissolved oxygen, Hydrogen ion concentration, Conductance, Temperature.

The Dunbar River, a small pristine woodland tributary of the St. John River, was monitored for seasonal variations in heterotrophic bacteria and physico-chemical water quality parameters from February 1977 to February 1978. Samples were drawn for analysis every other week. Temperature and oxygen levels were determined on site, and all other water parameters were determined at the Water Quality Laboratory of Environment Canada in Moncton, New Brunswick. Results were compared with those obtained in similar studies on the Meduxnekeag River, an upstream tributary of the St. John River. Both the Meduxnekeag and the Dunbar appeared oligotrophic, although the former received effluents of domestic and industrial wastewaters. A toxometric approach coupled with multivariate statistical analysis of bacterial populations showed a predominance of fluorescent Pseudomonas spp. Bacterial populations were largely psychrotrophs, and their numbers were limited by nitrogen. Temperature had a strong influence on in situ heterotrophic activity. Both rivers had ice covers for 5 months, during which the dissimilation of nitrate was increased. (Geiger-FRC)
W81-00770

THE EFFECT OF PHOTOCHEMICAL TREATMENT OF WATER ON ALGAL GROWTH,
Volcani Inst. of Agricultrual Research, Bet-Dagan (Israel). Inst. of Soil and Water

For primary bibliographic entry see Field 4A.
W81-00771

INTERACTING LIMITS TO ALGAL GROWTH: LIGHT, PHOSPHORUS, AND CARBON DIOXIDE AVAILABILITY,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
T. C. Young, and D. L. King.
Water Research, Vol 14, No 5, p 409-412, May, 1980. 3 Fig, 27 Ref.

Descriptors: *Eutrophication, *Aquatic algae, *Nutrients, *Limiting factors, Environmental effects, Plant growth, Light intensity, Phosphorus, Carbon dioxide, Nuisance algae.

New information regarding the interactions between some commonly recognized factors which limit algal growth is discussed with a view to adding to knowledge of the mechanisms of eutrophication and to contributing to the development of strategies to control its adverse impacts. Some of these factors include light, phosphorus, and carbon dioxide availability. A cyanophyte, Anacystis nidulans, was grown under conditions which gave a range of growth limitation for each of these factors. The effects of the three limiting factors on algal growth were readily apparent and demonstrate the existence of a positive interaction between light, phosphorus and carbon dioxide as regulators of algal carbon fixation. Algae incubated at high light with ample phosphorus grew faster over a wider range of carbon dioxide concentrations and a lower concentration of carbon dioxide than did algae grown under other conditions. Algae incubated at low light with only limited phosphorus grew at a lower rate over a narrower range of concentrations of carbon dioxide, and ceased growth at a higher concentration of carbon dioxide compared to other conditions. An initial dependence on the amount of illumination was noted in each study. The results suggest that interactions between limiting factors can be important in determining the rate and amount of algal growth in freshwater ecosystems. (Baker-FRC)
W81-00777

ACUTE TOXICITY AND BEHAVIORAL RESPONSES OF COHO SALMON (ONCORHYNCHUS KISUTCH) AND SHINER PERCH (CYMATOGASTER AGGREGATA) TO CHLORINE IN HEATED SEA-WATER.
Washington Univ., Seattle. Fisheries Research Inst.
Q. J. Stober, P. A. Dinnel, E. F. Hurlburt, and D. H. DiJulio.
Water Research, Vol 14, No 4, p 347-354, April, 1980. 5 Fig, 3 Tab, 3 Ref.

Descriptors: *Coho salmon, *Shiner perch, *Chlorine, *Thermal waters, Fish, Fish attractants, Fish behavior, Fish repellents, Toxicity, Bioassay, Effluents, Statistics, Sea water, Heated water.

The acute toxicity and behavioral responses of 1-yr-old coho salmon and 1-3-mo-old shiner perch to chlorinated sea-water at 13, 16, and 20C were determined. Both species were exposed to chlorine concentrations of 0.077-1.035 mg/liter, as measured by total residual oxidant (TRO), for 7.5, 15, 30, and 60 min. Shiner perch did not survive exposures exceeding 1.0 mg/liter TRO for 7.5 min. All survived a 60 min exposure at TRO concentrations of < 0.2 mg/liter. Coho salmon did not survive an exposure of 7.5 min at 0.5 mg/liter TRO or more. A survival of 100% after 60 min was observed at TRO concentrations of < 0.1 mg/liter. The mean 60 min LC50 for shiner perch was significantly reduced ($P < or = 0.05$), from 308 microg/liter TRO at 13C to 230 microg/liter at 20C. The 60 min LC50 for coho salmon decreased from 208 microg/liter TRO at 13C to 130 microg/liter at 20C. Coho salmon consistently avoided chlorine at all test concentrations from 2 to 500 microg/liter. Increased temperatures reinforced this response. A significant avoidance threshold was observed for shiner perch at 175 microg/liter TRO, while a significant preference response occurred at concentrations of from 10 to 100 microg/liter at 16 and 20C. This study indicates that the discharge of chlorinated effluents into sea-water may be attractive to some resident marine populations. (McKeon-FRC)
W81-00786

A PRESSURIZED PROPORTIONAL DILUTER FOR AQUATIC TOXICOLOGICAL STUDIES,
Environmental Protection Agency, Gulf Breeze, FL. Gulf Breeze Environmental Research Lab.
M. J. Hemmer.
Water Research, Vol 14, No 3, p 243-246, March, 1980. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Equipment, *Siphon, *Testing procedures, Analytical techniques, *Toxcity, Chlorinated hydrocarbon pestcides, Pumps, Carbamate pesticides, Pesticide toxicity, Laboratory tests, Sampling, Aquatic animals, Water pollution effects.

A proportional diluter which was recommended for use in routine aquatic toxicity tests by the committee on Methods for Toxicity Test With Aquatic Organisms (1975) is described. The half-liter proportional diluter uses positive pressure, with its primary siphons being activated by a pulse of pressure instead of by a partial vacuum as in conventional diluters. The need for venturi tubes, vacuum manifolds, and individual water blocks is eliminated by the device. Pressure is delivered through air cylinders, air compressor lines or air pumps. Performance evaluations of the diluter were conducted in 96-hour acute toxicity tests to the grass shrimp, Palaemonetes pugio, exposed to the organochlorine pesticide, endrin, or the carbamate pesticide, sevin. Recoveries of the pesticides from seawater samples wer greater than 90%. Other advantages of the proportional diluter include its ease of construction, calibration and cleaning, its low cost, compact size, and albility to conserve water. (Geiger-FRC)
W81-00795

A COMPARISON OF THE INFLUENCE OF IRON ON THE GROWTH AND NITRATE METABOLISM OF ANABAENA AND SCENEDESMUS,
State Univ. of New York at Fredonia.
D. R. Verstreate, T. A. Storch, and V. L. Dunham.
Physiologia Plantarum, Vol 50, p 47-51, 1980. 2 Fig, 4 Tab, 20 Ref. OWRT-B-074-NY(1), 14-34-0001-8102.

Descriptors: *Iron, Effects, *Growth rates, *Algae, *Cyanophyta, *Chlorophyta, Nitrate assimilation, Glutamine synthetase, Anabaena flos-aquae, Scenedesmus bijugatus.

A comparative study of growth and nitrate metabolism of Anabaena flosaquae (Lyng.) Breb, and Scenedesmus bijugatus var. seriatus Chodat investigated possible mechanisms for the iron-stimulated increases in growth specific for blue-green algae in mixed algal communities. Algae were separately grown in an inorganic medium with varying concentrations of iron and nitrate to determine the effects on each organism. Iron was found to be a limiting nutrient for cultures of both Anabaena and Scenedesmus as determined by chlorophyll a concentrations and cell enumeration. Both iron and nitrate stimulated the specific activity of nitrate reductase, nitrite reductase, and glutamine synthetase in Anabaena. Iron enrichment did not increase the activity of the enzymes in Scenedesmus, but inhibited the activity of nitrate reductase and glutamine synthetase. The stimulation of growth by iron in cells grown under iron limiting conditions was associated with increased nitrate metabolism in Anabaena but not in Scenedesmus.
W81-00808

ROLE OF THE U.S. FISH AND WILDLIFE SERVICE IN PUMPED STORAGE POWER PLANT PROJECTS,
National Power Plant Team, Ann Arbor, MI.
J. Boreman.
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J.P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 4-11. 4 Tab.

Descriptors: *Pumped storage, *Hydroelectric plants, *Environmental effects, *Wildlife, Water quality, Aquatic life, Streamflow, Methodology, Decision making, Permits, Information exchange, Fish, Habitats, Migration, Fish and Wildlife Service.

The construction and operation of pumped storage projects pose a threat to the well-being of the fish and wildlife resources of the United States. This threat results from potential environmental impacts such as entrainment and impingement of aquatic organisms, degradation of water quality, alteration of natural stream flows, removal of terrestrial habitat, and interference with migration pathways. The U.S. Fish and Wildlife Service is currently involved with pumped storage projects in two areas: review of license and permit applications, and research and development of information that can be used to minimize project impacts. To increase the effectiveness of this involvement, in the future the Fish and Wildlife Service will emphasize three areas of effort: development of an environmental information base, timely dissemination of information and methodologies to decision makers, and evaluation of the usefulness of the disseminated information and methodologies. (Moore-SRC)
W81-00839

THE KEOWEE-TOXAWAY PROJECT,
Duke Power Co., Charlotte. NC.
J. S. Garton.
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J.P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 12-20. 6 Fig, 1 Ref.

Descriptors: *Pumped storage, *Hydroelectric plants, *Water temperature, *Reservoirs, Thermal stratification, Hydraulic structures, Weirs, Dams, Reservoir design, Trout, South Carolina, Nuclear powerplants, Aquatic habitats, Environmental effects, *Keowee-Toxaway Project(SC).

The Keowee-Toxaway Project is located in the foothills and mountains of northwestern South Carolina. The project consists of a system of impoundments and power facilities including Keowee and Jocassee Reservoirs, the three-unit Oconee Nuclear Station, a conventional hydroelectric station at the Keowee dam, and a pumped storage hydroelectric station at the Jocassee dam. Each impoundment and power facility is briefly described. Representative water temperature profiles, both preoperational and operational, are given for each impoundment that indicate the general effects of project operations on thermal conditions. The design of these power plants includes a skimmer wall and submerged weirs that result in selective use of reservoir water for different functions. In Keowee Reservoir during summer the lower strata are warmed noticeably above preoperation conditions, and during winter temperatures cool to within a few degrees of the preoperation condition. The effect of pumped storage operations has been to lower the upper boundary of suitable trout habitat in Jocassee Reservoir. An additional pumped storage station, Bad Creek, is scheduled for construction above Jocassee Reservoir. In order to reduce the probability that the flows from the Bad Creek station will erode the trout habitat in Jocassee Reservoir through destratification, a submerged weir will be placed downstream of the discharge. (Moore-SRC)
W81-00840

PREDICTIONS OF EFFECTS OF PUMPED STORAGE HYDROELECTRIC OPERATIONS ON TROUT HABITAT IN JOCASSEE RESERVOIR, SOUTH CAROLINA,
Fish and Wildlife Service, Clemson, SC. Southeast Reservoir Investigations.
J. L. Oliver, and P. L. Hudson.

In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J.P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 21-25. 2 Tab, 6 Ref.

Descriptors: *Pumped storage, *Hydroelectric plants, *Trout, *Water temperature, Reservoirs, Aquatic habitats, Dissolved oxygen, Winter, Thermal stratification, South Carolina, Turnovers, Forecasting, Environmental effects, *Jocassee Reservoir(SC).

Jocassee Reservoir is the upper pool for the Jocassee Pumped Storage Station. Keowee Reservoir serves as the lower pool and as a cooling reservoir for the Oconee Nuclear Station. Although Jocassee reservoir supports an excellent fishery for both trout and warmwater species, increased operation of the power stations has resulted in a continual decline in the volume of trout habitat from 1973 to 1976. Temperature and dissolved oxygen profiles were taken monthly at three stations in Jocassee Reservoir since August 1973 and at one station in the tailwaters since April 1972. Two regression equations describing the effect of pumped storage operations were developed: both estimate the volume of trout habitat during the most critical period of the summer, before fall overturn. Various combinations of minimum winter water temperature (MWWT) and pumping volumes were used to predict September trout habitat. On the basis of estimated 1985 and 1991 pumping volumes it is estimated that trout habitat will be present in those years after cold winters, but that it may be nearly or completely eliminated after a typical or warm winter. (Moore-SRC)
W81-00841

ENTRAINMENT OF ICHTHYOPLANKTON AT JOCASSEE PUMPED STORAGE STATION,
Fish and Wildlife Service, Clemson, SC. Southeast Reservoir Investigations.
E. D. Prince, and L. J. Mengel.
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J. P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 26-39. 3 Fig, 2 Tab, 20 Ref.

Descriptors: *Pumped storage, *Hydroelectric plants, *Entrainment, *Larvae, *Fish, Reservoir operation effects, South Carolina, Mortality, Penstocks, Reservoirs, Diel migration, Ecology, Jocassee pumped storage station(SC).

The entrainment of larval fish at Jocassee pumped Storage Station, South Carolina, has been studied since April 1977 to evaluate the effects of power plant operations on fish populations. Duplicate weekly samples of fish larvae were taken in 1977 during generation and pumping using plankton nets. A frame trawl has been used to sample larval fish throughout the upper and lower reservoirs and to assess diel depth distribution at both ends of the penstocks. About six times more larvel fish were entrained during pumping than during generation in 1977. The differences in the densities of larvel fish passing through the pumped storage station during different modes of operation appear to be related to three major factors: configuration of the basin surrounding the penstock openings; diel depth distribution of the fish larvae; and times of day during which the plant operated. About 7% of the larval clupeids in Keowee Reservoir were killed due to operation of the pumping mode in 1977. (Moore-SRC)
W81-00842

REVIEW OF THE LITERATURE ON THE EFFECTS OF PUMPED STORAGE OPERATIONS ON ICHTHYOFAUNA,
Georgia Power Co., Atlanta.
R. D. Miracle, and J. A. Gardner, Jr.
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J.P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 40-53. 71 Ref.

Descriptors: *Pumped storage, *Hydroelectric plants, *Fish, *Mortality, Reservoir operation effects, Ecology, Aquatic habitats, Water temperature, Dissolved oxygen, Velocity, Water levels, Reservoirs, Entrainment, Animal pathology, Pressure, Growth stages.

Pumped storage operations pass large volumes of water from one reservoir to another, ultimately affecting fishes, either by entrainment in withdrawn waters or by modification of the aquatic environment. Mortality caused during entrainment is primarily due to the following physical stresses: abrasion and collision; pressure changes; velocity changes; and acceleration effects. Fish passage or entrainment is influenced by: size and life stage of fish; susceptibility of the fish which directly relates to life history aspects; and physical characteristics of the pumped storage facility. Pumped storage facilities can adversely affect reservoir hydrology through changes in water level, water temperature, dissolved oxygen and water velocity. Although adverse effects of pumped storage can be severe when drastic modifications result from plant operations, most fish populations are able to adapt to the changing environments encountered at facilities in the United States. (Moore-SRC)
W81-00843

STUDIES OF THE EFFECTS OF OPERATING THE MT. ELBERT PUMPED STORAGE POWERPLANT,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
J. F. LaBounty, and R. A. Roline.
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J. P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80-28, April, 1980, p 54-66. 3 Fig, 1 Tab, 38 Ref.

Descriptors: *Pumped storage, *Hydroelectric plants, *Aquatic habitats, Reservoir operation effects, Ecology, Mortality, Aquatic life, Limnology, Fish, Shrimp, Sampling, Lake sediments, Ecosystems, Colorado, *Twin Lakes(CO).

The Mt. Elbert Pumped Storage Powerplant is located on the northwest shore of the lower lake of Twin Lakes near Leadville, Colorado. Construction of the powerplant started in February 1972, and initial operation of the first of two units is planned for 1981. In 1971, the Water and Power Resources Service initiated studies to obtain limnological and fishery data in an attempt to better understand the environmental impacts of pumped storage. Past, ongoing, and planned research on the Twin Lakes ecosystem is reviewed. Expected impacts resulting from powerplant operation include fish and mysis shrimp mortality, stirring of lake sediments, and changes in the physical environment of Twin Lakes. To assess and quantify the impacts of pumped storage on Twin Lakes biota, sampling facilities in the tailrace of the lower lake and in the Mt. Elbert forebay are being designed and constructed. These structures and techniques will allow sampling of aquatic organisms at any time during the pumping and generation modes of the powerplant. (Moore-SRC)
W81-00844

PREOPERATIONAL FISHERY INVESTIGATIONS OF TWIN LAKES, COLORADO,
Colorado Div. of Wildlife, Buena Vista.
T. P. Nesler.
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J.P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 67-79. 6 Fig, 3 Tab, 8 Ref.

Descriptors: *Pumped storage, *Sport fishing, *Rainbow trout, *Lake trout, Creel census, Baseline studies, Fish populations, Reservoirs, Ice fishing, Lake fisheries, Sampling, Colorado, *Twin Lakes(CO).

Twin Lakes, near Leadville, Colorado, is the first of Colorado's reservoirs to be developed as a pumped storage site. The fishery at Twin Lakes can be classified into two major components: stocked rainbow trout fishery during the open-water season, and lake trout during the ice fishing season. Because of the potential impact of pumped storage operations on the sport-fishing harvest, a creel census and a standardized program of gillnet sampling were initiated in 1973. Annual harvests of rainbow trout for both lakes during the open-water season ranged from over 25,000 to 43,000 during 1974-1977, and over 81,000 in 1973. Lake trout harvested in 1974-1977 ranged from 1,000 to 1,500 fish. Fishermen-hours on the lower lake were approximately 2-3 times greater than estimates for the upper lake. On the lower lake, the catch rate for shore fishermen ranged from 0.25-0.44 fish per man-hour, and for boat fisherman ranged from 0.17-0.27 fish man-hour. With the exception of one season, ice fishing catch rates ranged from 0.11-0.14 fish per man-hour and lake trout composed 89% or more of the total harvest. (Moore-SRC)
W81-00845

SUMMARY OF ECOLOGICAL STUDIES OF FISHES IN MUDDY RUN PUMPED STORAGE POND, PENNSYLVANIA,
Radiation Management Corp., Drumore, PA.
P. G. Heisey, and D. Mathur
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J.P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 80-94. 2 Fig, 5 Tab, 11 Ref.

Descriptors: *Pumped storage, *Hydroelectric plants, *Fish populations, *Ecology, Reservoirs, Fish reproduction, Mortality, Entrainment, Pennsylvania, Muddy Run pumped storage pond(PA), Conowingo Pond(PA)

Muddy Run Pumped Storage Pond and Conowingo Pond are located in southeastern Pennsylvania. Most water for Muddy Run is drawn form Conowingo. Most of the fish species inhabiting the lower pond (Conowingo) were entrained by the Muddy Run Station soon after it commenced operation; however, fish entrainment and mortality at Muddy Run Station had little impact on fish populations in Conowingo. Variations in abundance of many common fishes in Conowingo appear to depend upon success or failure of individual year classes and not on operation of Muddy Run Station. Total standing crop of fishes in Muddy Run compares favorably with that from numerous non-pumped storage reservoirs except for sunfishes and crappies. Data collected in recent years indicate that a more favorable game fish to rough fish ratio is developing in Muddy Run. Reproductive success of most fishes in Muddy Run was limited by water level fluctuations. Numerous fish appear to be recruited from a constant elevation lake set aside for recreation (Moore-SRC)
W81-00846

WATER QUALITY AT THE TVA RACCOON MOUNTAIN PUMPED STORAGE PLANT,
Tennessee Valley Authority, Chattanooga. Div. of Water Resources.
H. Olem, and L. H. Woosley, Jr
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J.P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 95-108. 9 Fig, 4 Ref.

Descriptors: *Pumped storage, *Hydroelectric plants, *Dissolved oxygen, *Reservoirs, Stratification, *Water quality, Hydrogen ion concentration, Aquatic productivity, Diurnal, Tennessee, *Raccoon Mountain pumped storage plant(TN)

The Raccoon Mountain Pumped Storage Plant, just west of Chattanooga, Tennessee, has been providing peaking and reserve capacity requirements to the Tennessee Valley Authority power system since 1978. Because of the potential for low concentrations of dissolved oxygen in releases from the upper reservoir having a significant impact on the water quality of the lower reservoir, Nickajack Lake, the water quality in the upper reservoir and in reservoir releases is investigated. Operation of the Raccoon Mountain Plant on a routine basis did not result in releases of water containing dissolved oxygen concentrations below 4.0 mg/l. When water released from the upper reservoir was below 5.0 mg/l, the calculated decrease in dissolved oxygen in Nickajack Lake after mixing was less than 5%. The newly formed upper reservoir exhibited dissolved oxygen stratification in the upper layer during routine summer operation in 1979 due to a biologically productive surface layer. Dissolved oxygen concentrations between 8.9 and 11.4 mg/l were measured in the upper three meters. Diurnal fluctuations of pH and dissolved oxygen in the upper layer of the upper reservoir were observed during routine summer operation. (Moore-SRC).
W81-00847

EFFECTS OF PUMPBACK STORAGE ON ZOOPLANKTON POPULATIONS,
Virginia Polytechnic Inst. and State Univ., Blacksburg, VA.
A. L. Buikema, Jr., and P. H. Loeffelman.
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J.P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 109-124. 10 Fig, 22 Ref.

Descriptors: *Pumped storage, *Hydroelectric plants, *Thermal statification, *Zooplankton, Virginia, Water temperature, Crustaceans, Rotifers, Aquatic animals, Limnology, Predation, *Smith Mountain Lake(VA).

The impact of pumped storage operations on the aquatic mirofauna of impoundments was investigated at Smith Mountain Lake, a mainstream pumped storage complex southeast of Roanoke, Virginia. Smith Mountain Lake was sampled for zooplankton and water temperature at four stations once a month for 13 months and then at two stations once a day for seven days. The most obvious effect of pumpback on temperature was disruption of thermal stratification in the forebay. Thermal layers fluctuated greatly, and isolated lenses of water of differing temperature were apparent. A total of 1088 pump samples and 104 tow samples were qualitatively and quantitatively analyzed for zooplankton. Forty-nine species of rotifers, 15 species of Cladocera, and 8 species of copepods were identified. It appears that the interaction of pumped storage operation and zooplankton populations in Smith Mountain Lake is very complex. Pumpback appears to stimulate predation, and normal thermal characteristics of the lake were altered to the apparent benefit of the zooplankton. (Moore-SRC)
W81-00848

A MATHEMATICAL MODEL TO ASSESS THE EFFECTS OF PASSAGE OF ZOOPLANKTON ON THEIR RESPECTIVE POPULATIONS,
Stone and Webster Engineering Corp., Boston, MA.
T. J. Horst.
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumed Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J.P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 177-189. 9 Fig, 3 Tab, 7 Ref.

Descriptors: *Pumped storage, *Hydroelectric plants, *Mathematical models, *Zooplankton, *Mortality, Limnology, Aquatic animals, Entrainment, Crustaceans, Sweden, *Lake Ivosjon(Sweden).

A mathematical model is used to study the operational effects of the proposed Vastana pumped storage plant on the Lake Ivosjon, Sweden, ecosystem by assessing the effects of withdrawal and discharge of water on zooplankton. Bosmina coregoni was selected as representative of zooplankton with a relatively rapid development time and Eudiaptomus graciloides was selected as the representative of long-lived zooplankton. A series of simulations was conducted to assess the effects of power plant operation on the populations of the zooplankters. Mortality values of 10%, 50%, and 100% were used for entrainment mortality. The percent reduction in the Bosmina population was 2% for the low entrainment mortality, and 8 to 12% for the assumption of total mortality of entrained organisms. The percent reduction in the Eudiaptomus population was 2% for the low entrainment mortality and 9 to 16% for the assumption of total entrainment mortality. Except for the most extreme cases simulated, the predictions fall within the range of measured variation. Based on this study, the proposed Vastana plant is expected to have a tolerable effect on the lake ecosystem. (Moore-SRC)
W81-00852

TOXIC SUBSTANCES FROM FRESHWATER ALGAE,
Alberta Univ., Edmonton. Dept. of Botany.
P. R. Gorham, and W. W. Carmichael.
Progress in Water Technology, Vol 12, No 2, p 189-198, 1980. 1 Fig, 3 Tab, 36 Ref.

Descriptors: *Cyanophyta, *Eutrophication, *Algal toxins, *Scum, *Poisons, Toxicity, Freshwater, Animal groupings, Chemicals, Chemical properties.

Toxins isolated from strains of freshwater planktonic blue-green algae are discussed including their structure and toxicity. Known Microcystis toxins are either a fast-acting/low-molecular weight alkaloid or a slow-acting, comparatively small polypeptide. Toxins isolated from Anabaena and Aphanizomenon strains are fast-acting, low-molecular weight alkaloids. Recent research has identified toxins from Anabaena and Microcystis that are different from ones studied earlier. A pteridine toxin has been isolated from a strain of Synechococcus. Poisoning by freshwater blue-green algae is now better understood because of these findings. To cause poisoning, a waterbloom or scum must have a relative proportion of one or more toxic strains that equals or exceeds a poisonous threshold value and maintain this composition of species for a period of time. The threshold will differ with the species and strains of toxic algae involved, the amounts ingested, and the target animals. Achieving and maintaining toxic levels depends on growth conditions, phytoplankton and zooplankton, decomposition and detoxification mechanisms, lysis, agglomeration, and others. (Small-FRC)
W81-00855

THE SIGNIFICANCE OF THE PREDATOR FOOD CHAIN IN LAKE METABOLISM,
Trondheim Univ. (Norway). Zoological Dept.
A. Langeland, and P. Larsson.
Progress in Water Technology, Vol 12, No 2, p 181-187, 1980. 1 Fig, 29 Ref.

Descriptors: *Zooplankton, *Eutrophication, *Fish populations, *Predation, *Lakes, Biological communities, Primary productivity, Phytoplankton, Cyanophyta, Europe, Food chains.

Selective fishing as a biological tool in the control of eutrophication of lakes is discussed. Field studies are cited to demonstrate the significance of the predator food chain in lakes. Increased self-purification has been reported in serveral limnetic water bodies when large filter feeding cladocerans were allowed to increase their populations. Fish predation reduces the size of zooplankton populations, causing less efficient grazing on phytoplankton. In most cases when large cladoceran populations develop, the general phytoplankton biomass is reduced. There is also usually a reduction in the amount of blue green algae. An additional positive factor is that the fish may be harvested and serve as a food for man. (Small-FRC)
W81-00856

EFFECTS OF EUTROPHICATION ON ZOOPLANKTON,
Commission of the European Communities, Ispra (Italy). Phsyical and Natural Sciences Dept.
O. Ravera.
Progress in Water Technology, Vol 12, No 2, p 141-159, 1980. 1 Fig, 3 Tab, 61 Ref.

Descriptors: *Zooplankton, *Eutrophication, *Methodology, *On-site investigations, Lake stages, Nutrients, Water pollution effects, Industrial wastes, Predation, Cladocerans, Reviews.

A review is presented of the methodologic difficulties and the uncertainty in interpreting results of studies on the variation of zooplankton with eutrophication. Two methods are normally used: a comparison of characteristics of zooplankton within the same body of water as eutrophication levels change, and comparison of zooplankton in different bodies of water with different levels of trophy. Zooplankton samples are collected from sediment cores, and Cladocerans are usually studied. The influence of phytoplankton, the effects of predation, and the succession of species are discussed. Because of the combined influences of nutrient enrichment, industrial pollution, and the introduction of planktivore fish on zooplankton communities, it can be difficult to determine the effects of eutrophication. The most successful studies apply different methods to the same body of water to obtain a more complete picture of zooplankton changes. (Small-FRC)
W81-00857

THE INFLUENCE OF EUTROPHICATION ON DEEP LAKE BENTHIC INVERTEBRATE COMMUNITIES,
Bergen Univ. (Norway). Zoological Museum.
O. A. Saether.
Progress in Water Technology, Vol 12, No 2, p 161-180, 1980. 8 Fig, 1 Tab, 53 Ref.

Descriptors: *Zooplankton, *Eutrophication, *Lakes, *Succession, Biological communities, Great lakes, Phosphorus, Lake stages, Europe, Water pollution effects, Oligochaetes, Chironomids.

Case histories are presented of eutrophication in the following deep lakes: Vattern, Malaren, Constance, Geneva, Maggiore, Mergazzo, Taho, the Great Lakes, and the Okanagan Lakes. In most of these lakes the first reaction to eutrophication was an increase in abolute and relative amounts of oligochaetes without any change in species composition. Shaeriids, large crustaceans, and chironomids also increased in number. Further, there is a shift in relative abundance of common species. When a strongly oligotrophic lake changes to a less strongly oligotrophic lake, only species of chironomids may be eliminated from the profundal zone. A study of characteristic chironomids in lakes of different trophic levels indicated 15 subdivisions of communities. A significant correlation was found between the 15 subdivisions and chlorophyll a/mean depth and between subdivisions and total phosphorus/mean depth. These correlations indicate that while it is easy to change benthic communities from ultraoligothrophic to moderately oligotrophic, it takes higher shifts in primary production to change oligotrophic to mesotrophic or mesotrophic to eutrophic. More primary production is needed to change the benthic communities as the depth of the lake increases. (Small-FRC)
W81-00858

BLUE-GREEN ALGAE IN LAKE MJOSA AND OTHER NORWEGIAN LAKES,
Norsk Inst. for Vannforskning, Oslo.
O. M. Skulberg.
Progress in Water Technology, Vol, 12, No 2, p 121-140, 1980. 13 Fig, 1 Tab, 35 Ref.

Descriptors: *Eutrophication, *Lakes, *Nutrients, *Algal control, Algae, Water quality, Aquatic environment, Water properties, Phosphorus, Water pollution, Lake Mjosa, Norway.

Various lakes in Norway were investigated to determine increases in blue-green algae resulting from human activities that have changed the oligotrophic conditions of the waters. These activities include waste disposal and agriculturally related pollution. The trophic nature of inland waters is closely linked with the growth of planktonic algae. Evidence of trophic changes in algal growth includes variations in the major components of phytoplankton, studied from May through November of 1976. In some regions of Norway, eutrophication has been associated with invasions of planktonic species of Oscillatoria which are able to develop dense populations in lakes and slow flowing rivers. Climatic conditions also influence phytoplankton development. It is concluded from current research that an invasion of blue-green algae occurs under disturbed ecological conditions. Eutrophication provides a sequence of events leading to mass development of vegetation with blue-green algae. Eutrophication is a continuous and coherent phenomenon, and thus control measures must concentrate on local reservoirs of the blue-green algae. (Baker-FRC)
W81-00859

THE CASE OF LAKE MJOSA,
Norsk Inst. for Vannforskning, Oslo.
H. Holtan.
Progress in Water Technology, Vol 12, No 2, p 103-120, 1980. 13 Fig, 4 Tab, 45 Ref.

Descriptors: *Eutrophication, *Lakes, *Nutrients, *Algal control, Water qulaity, Aquatic environment, Water properties, Phosphorus, Nitrogen, Algae, Lake Mjosa, Norway.

Lake Mjosa is located 121 m above sea level and has a surface area of 365 square km, an average water depth of 153 m, maximum depth of 447 m, and a volume of about 56 cubic km. The lake with several tributary valleys extends far into Norway's largest mountain area, Jotunheimen. The total phosphorus supplied to the lake in tons per year for 1973 through 1977 ranged from 396.8 to 218.9 tons. Samples were taken from the lake four times a year from 1966 to 1974 to perform eutrophication studies. Eutrophication is occurring as a result of continuously increasing supplies of nutrients and other growth stimulating substances entering the lake. The phosphourus load is not the only problem. Increasing supplies of nitrogen and nitrate have also been noted. The phytoplankton biomass in general has consisted of diatoms, but in the latter part of 1976 summer season the blue-green alga Oscillatoria bornetii fa. tenuis became dominant. A plan has been drawn up for restoration of the water and is described. (Baker-FRC)
W81-00860

EUTROPHICATION OF ALPINE LAKES,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung Und Gewaesserschutz, Zurich (Switzerland).
H. Ambuhl.
Progress in Water Technology, Vol 12, No 2, p 89-101, 1980. 8 Fig, 2 Tab, 1 Ref.

Descriptors: *Eutrophication, *Lakes, *Nutrients, Water quality, Limnology, Aquatic environment, Water properties, Oxygen, Phosphorus, Alpine lakes, Switzerland.

Eutrophication is discussed as it occurs in alpine lakes which are strongly influenced by their mountainous surroundings, many being relatively deep, quite steep walled, and in certain cases even typical of fjord lakes with partly tectonic origin. Phosphorus plays the major role in determining the extent of photosynthesis in lakes. The load of phosphate which leads to eutrophication depends on various parameters including local climate, wind exposure, morphometry, retention time and others. Some general comments on phosphorus loading of alpine lakes are given. It is noted that the existence of dissolved oxygen in the near-bottom water does not necessarily exclude the possiblity of phosphorus release from the sediment into the waterbody, which thus leads to self-fertilization of the lake. Morphometric and hydrographic data are given for several lakes. The vertical distribution of the oxygen content in Swiss lakes at the end of the summer stagnation for 1965-1975 is graphed. The possibility of restoration of small and hallow lakes by lowering phosphorus load and by internal lake measures such as aeration, hypolimnion drainage and others is considered. (Baker-FRC)
W81-00861

APPLICATION OF US OECD EUTROPHICATION STUDY RESULTS TO DEEP LAKES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. A. Jones, and G. F. Lee.
Progress in Water Technology, Vol 12, No 2, p 81-88, 1980. 4 Fig, 1 Tab, 6 Ref.

Descriptors: *Eutrophication, *Lakes, *Model studies, Aquatic environment, Water properties, Algal control, Algae, US OECD eutrophication model, Norway, Lake Mjosa.

The US portion of the OECD eutrophication study was recently completed and applied to a deep Norwegian lake, Lake Mjosa. This portion of the OECD nutrient load-eutrophication response model demonstrated that the Vollenweider approach of using phosphorus load normalized by mean depth and hydraulic residence time to predict the planktonic algal chlorophyll in the waterbody is valid for a wide variety of waterbodies. This particular lake shows the same normalized phosphorus load-planktonic algal chlorophyll relationships. It is concluded that the OECD eutrophication modeling approach and the nutrient load-eutrophication response relationships developed by Vollenweider and expanded by the US together present a powerful tool to assess the impact of eutrophication control programs. Water quality managers will be able to predict with a high degree of reliability the changes in water quality that will occur as a result of reducing the phosphorus input to a waterbody by a certain magnitude. (Baker-FRC).
W81-00862

QUANTIFYING THE EUTROPHICATION PROCESS: DIFFICULTIES CAUSED, FOR EXAMPLE, BY SEDIMENTS,
For primary bibliographic entry see Field 2K.
W81-00863

EUTROPHICATION IN RELATION TO THE LOAD OF POLLUTION,
Uppsala Univ. (Sweden). Inst. of Limnology.
For primary bibliographic entry see Field 2K.
W81-00883

EUTROPHICATION OF NORWEGIAN FRESHWATERS IN RELATION TO NATURAL CONDITIONS,
Oslo Univ. (Norway).
J. Kjensmo.
Progress in Water Technology, Vol 12, No 2, p 39-47, 1980. 4 Tab, 17 Ref.

Descriptors: *Eutrophication, *Phosphorus, *Glacial soils, Bedrock, Soil chemistry, Soil structure, Soil types, Rocks, Glacial sediments, *Norway, Lakes, Rivers.

The natural supply of phosphorus to Norwegian fresh water is considered. The most important natural source for phosphorus supply is the rocks and soils in the drainage areas of lakes and rivers. The bulk of phosphorus in rock is in the form of apatite. Surface soil layers are often rich in phosphorus due to the plant detritus in various stages of decomposition. Total phosphorus levels in 14 Norwegian lakes were determined. The range is from 3.8 to 5.8 micrograms/liter in a group of Permian lakes. Two humic influenced lakes which are situated in Pre-Eocambrian and Eocambrain rocks have total P contents of 8.8 and 10.3 micrograms/liter, respectively. The export of total P from the watersheds of some Norwegian rivers ranges from 4.0 to 57.3 mg/sq m/year. The annual average export derived from 7 watersheds which consist mainly of forested and unproductive igneous areas was found to be 7.2 mg/sq m/year. The findings in rivers and lakes studied demonstrate the large scale of natural oligotrophic features in the watersheds of Norway. (Baker-FRC)
W81-00884

SANITARY AND AESTHETIC QUALITY OF THE COASTAL WATERS OF SPAIN,
Ministry of Public Health and Social Security, Madrid (Spain).
For primary bibliographic entry see Field 5B.
W81-00888

COMBINED EFFECTS OF DODECYL BENZENE SULFONATE AND LOW SALINITIES ON TISBE BULBISETOSA (COPEPODA: HARPACTICOIDA),
National Research Council, Venice (Italy). Inst. of Marine Biology.
L. Dalla Venezia, V. U. Fossato, and S. Scarfi.
Progress in Water Technology, Vol 12, No 1, p 109-117, 1980. 3 Fig, 2 Tab, 9 Ref.

Descriptors: *Toxicity, *Laboratory tests, *Alkylbenzene sulfonates, *Salinity, Water pollution, Water pollution effects, Sea water, Invertebrates, Tisbe bulbisetosa.

Laboratory experiments analyzed the effects of four concentrations of dodecyl benzene sulfonate (DBS), a component of commercial detergents, at four salinity levels on adult Tisbe bulbisetosa. The methylene method of anlysis was used to control stability of DBS over time. The effective concentration of DBS decreased within two weeks after preparation of solutions. This decrease seemed to be dependent on the initial concentration and the salinity level. The noxiousness of detergents decreased as salinity increased. The two-day LC50 of DBS in sea water with 36% salinity was 5.12 ppm. This is higher than expected, indicating that the other components of domestic detergents are toxic and that all the components together may have a synergistic effect. (Small-FRC)
W81-00889

EFFECT OF LEAD SPECIATION ON TOXICITY,
Clemson Univ., SC. Dept. of Zoology.
M. L. Freedman, P. M. Cunningham, J. E. Schindler, and M. J. Zimmerman
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 389-393, May-June, 1980. 1 Fig, 3 Tab, 13 Ref.

Descriptors: *Phosphates, *Speciation, *Lead, Metals, Hydrogen ion concentration, Bioassay, *Model studies, Cations, Chemical properties, Chemical reactions, *Toxicity, Limnology, Aquatic environment, Mathematical studies, Kinetics.

In limnological and aquatic toxicity studies the interactions between ligands and metals are often ignored. Tests were conducted to show the effects of phosphate on toxicity of lead in a synthetic medium. The REDEQL2 chemical equilibrium model was used to calculate lead speciation at different total concentrations of lead and phosphate and at pH 6 or 8. At pH 6, very little free lead was found to exist at high phosphate concentrations, regardless of total lead levels. Little free lead was predicted at any phosphate level at pH 8. Static bioassays on the amphipod, Hyallela azteca, were conducted to test the role of free lead versus total lead in causing toxicity. Graphs of mortality data for the maximum lead level (5 milligrams/liter) at three different phosphate levels show the detoxifying effect of increasing phosphate concentrations. Some physiological stresses due to the synthetic media, observed via control mortalities, explain slight deviations of observed results from predicted values at the highest (0.003 M) levels of phosphate tested. These findings demonstrate the value of chemical and kinetic equilibrium models in examining the interaction of extraneous substances which might affect results in aqueous systems. (Geiger-FRC)
W81-00902

PARAQUAT TOXICITY TO LOUISIANA CRAYFISH (PROCAMBARUS CLARKII),

Southern Univ., Baton Rouge, LA. Dept. of Biological Sciences.
T-S. Leung, S. M. Naqvi, and N. Z. Naqvi.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 465-469, May-June, 1980. 2 Fig, 4 Tab, 9 Ref.

Descriptors: *Bioassays, *Mortality, *Crayfish, *Toxicity, *Mississippi River, *Paraquat, Lethal limits, Aquatic ecosystems, Rivers, Water pollution, Herbicides, Aquatic animals, Crustaceans, Chlorinated hydrocarbon pesticides, Organophosphorus pesticides, Water pollution sources.

Paraquat is highly soluble in water and is used extensively in Louisiana to control all annual grassy and broadleaf weeds. If sufficient levels of the herbicide reach aquatic ecosystems, toxic effects on aquatic species might occur. The toxicity of paraquat to adult and juvenile Louisiana crayfish, an important human food, was examined in laboratory tests. Bioassays were conducted in Mississippi River Bayou water, with adult crayfish being exposed to 6 concentrations of paraquat (15-100 ppm) and juveniles to 5 levels of the herbicide (0.5-8.0 ppm). Dissolved oxygen, temperature, pH, and crayfish mortality were checked every 24 hours over the course of 96 hours. A significantly greater amount of oxygen was consumed by treated crayfish, in a dose-dependent and exposure time-dependent pattern. At 25 ppm, no mortality occurred in adults, while at only 8 ppm, 50% mortality was found for juvenile crayfish after 24 hours. The death rate increased with exposure time for both juveniles and adults. Juveniles proved more susceptible than adults to paraquat in the present study, and also to aldrin and mirex in other experiments reported in the literature. Adult crayfish also showed a dose-dependent hyperactivity with exposure to paraquat; this was not explained. (Geiger-FRC)
W81-00903

LEAD IN THE MARINE ENVIRONMENT,
M. Waldichuk.
Marine Pollution Bulletin, Vol 11, No 9, p 241-242, September, 1980.

Descriptors: *Lead, *Sea water, Toxicity, Analytical techniques, Regulation, Europe, Water analysis, Absorption, Water pollution, Heavy metals.

A general discussion is presented of lead, its toxicity, and research and monitoring efforts in marine environments. Reliable analyses of lead in sea water have been plagued with problems of contamination, interference, and high background levels. The California Institute of Technology has conducted some high quality analyses using the isotopic dilution technique with mass spectrometry. The Marine Biological Association of the United Kingdom in Plymouth has done some of the best work on lead uptake. New British regulations effective April 12, 1980 set specific limits for lead in fish (2 mg/kg) and shellfish (10 mg/kg). (Small-FRC)
W81-00904

AN APPARATUS FOR THE PREPARATION OF VARYING CONCENTRATIONS OF CHEMICALS FOR TOXICITY TESTS WITH AQUATIC ORGANISMS,
Natural Environment Research Council, (Bangor Wales). Marine Invertebrate Biology Unit.
A. R. Manley.
Water Research, Vol 14, No 8, p 1023-1027, August, 1980. 6 Fig, 6 Ref.

Descriptors: *Toxicity, *Water pollution, *Laboratory equipment, *Aquatic life, Monitoring, Testing, Aquatic environments, Research equipment, Automatic control, Model studies, Performance, Fluctuations, Simulation analysis, Discharge.

An increase in the chemical pollution of the aquatic environment has prompted the manufacture of an array of equipment to simulate chemical discharges for toxicity testing under a variety of environmental conditions. The apparatus described here is capable of producing planned variations in chemical levels for aquatic toxicity tests to allow more realistic study of naturally occurring variations and their effects on aquatic life. The apparatus was designed to produce chemical concentration gradients over short or extended time spans at high flow rates. The apparatus was also made from chemically inert material. The new device was equipped with an animal chamber, constant head tanks, uncontaminated water at a constant flow, a distilled deionized water stock tank, a mixing chamber, peristaltic pump, a chemical solution stock tank, Teflon tubing, an Ultrograd and an Ultrograd valve. Satisfactory levels of accuracy are achieved in chemical dosing with the apparatus under a variety of toxicity testing conditions. However, abrupt changes in the concentration of a pollutant still cause problems in the system resulting in about a 4.5 minute delay between actual and recorded concentrations. (Geiger-FRC)
W81-00919

RIPARIAN ECOSYSTEMS: A PRELIMINARY ASSESSMENT OF THEIR IMPORTANCE, STATUS, AND NEEDS.
Fish and Wildlife Service, Kearneyville, WV. Eastern Energy and Land Use Team.
Report, August 1980. 18 p, 64 Ref.

Descriptors: *Wildlife habitats, *Riparian land, *Ecosystems, *Floodplains, Water quality, Fish, Esthetics, Value, Land use, Land management, Economic justification, Conservation, Water quality, Wetlands, Environmental effects, Evaluation.

Riparian ecosystems have outstanding values for fish and wildlife, supporting very diverse and productive animal communities. A majority of the nation's wildlife, including a relatively large proportion of endangered species depend on riparian habitats for survival. In their natural condition floodplain ecosystems have tremendous intrinsic and potential values. Riparian systems function as a buffer between aquatic ecosystems and potential values. Riparian systems function as a buffer between aquatic ecosystems and potential impacts of upland activities upon water quality. Most riparian systems are jeopardized by intensive economic pressures for a variety of alternative land and water uses, including channelization, farming, flood control, grazing, hydroelectric projects, irrigation, water salvage efforts, and recreation. Consequently, 70 to 90% of all original riparian communities in the United States have already been destroyed. High fish and wildlife values, multiple intrinsic values and high economic values of natural riparian ecosystems argue for their protection and management. Extensive and continued loss of riparian habitat and associated fish and wildlife populations is testimony to the ineffectiveness of present conservation efforts. (Moore-SRC)
W81-00929

A MATHEMATICAL MODEL SIMULATING FISH LOSSES NEAR POWER PLANTS USING ROTENONE DATA,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemical and Environmental Engineering.
C. Kleinstreuer, and B. E. Logan.
Water Research, Vol 14, No 8, p 1047-1053, August, 1980. 7 Fig, 3 Tab, 33 Ref.

Descriptors: *Model studies, *Power plants, *Rotenone, *Fish populations, *Mortality, Toxicity, Lakes, Rivers, Aquatic ecosystems, Mathematical studies, Hydrodynamics, Temperature, Environmental effects, Future planning, Screens, Intakes.

Impingement studies at power plants have shown that cooling water intake screens have played a major role in fish loss and alterations in aquatic biota. The present study examines the main factors causing impingement, and attempts to develop an indicator to predict high impingement losses and which fish species will be affected. Far field estimates were used to gather data on flow patterns, temperature, and fish populations. Rotenone data was used specifically for estimating fish numbers because its application to the power plants was most consistent year after year. A method was devised to utilize rotenone samples to predict which fish species were the most likely to be impinged in greatest quantity based on their abundance in the fishery. The model was successfully applied to the Arkansas Nuclear One Plant (a lake with a long intake canal) and Brown's Ferry, Tennessee (a river with a short intake canal). The impingement model was also designed to be applicable to other sites for toxicity or fish mortality studies. It was proposed that the model along with the systems analysis approach be used in future planning in regard to optional location and design of power plant facilities. (Geiger-FRC)
W81-00933

STREAM CATION CONCENTRATIONS AND LOSSES FROM DRAINAGE BASINS WITH CONTRASTING LAND USES IN SOUTHERN ONTARIO,
York Univ., Toronto (Ontario). Dept. of Geography.
A. R. Hill.
Water Research, Vol 14, No 9, p 1295-1305, September, 1980. 5 Fig, 6 Tab, 18 Ref.

Descriptors: *Minerals, *Agricultural watersheds, Land management, Cations, Land use, Effects, Forest watersheds, Urban drainage, Ontario.

Factors affecting the concentration and loss of calcium, magnesium, potassium and sodium from 22 watersheds near Toronto, Ontario were investigated over a 27 month period. Human activities in agricultural and land use practices, soils, surface geology and topographic features were considered in relation to mineral and nutrient levels of the watersheds. Positive relationships were noted between calcium and potassium levels and crop area, while a negative correlation was observed between these cations and abandoned farm land plus forest and sand areas plus sandy loam soils. Multicolinearity was found between land use and soils, resulting in the association of soil properties and farming activities with stream cation levels. Lower annual stream discharges in agricultural watersheds than in watersheds surrounded by areas of forest and non-farm lands caused no correlations to appear between crop area and annual losses of calcium and potassium. Losses of potassium and sodium and stream levels of these cations were positively correlated with urban land use. Urban sampling regimes established that these areas are major supply wells for sodium and to a lesser extent, potassium, eventually found in streams. Variations in watershed hydrology had a major effect upon levels of magnesium, with little influence from urban or agricultural land use. (Geiger-FRC)
W81-00941

BIOACCUMULATION PROFILES OF 35S-LABELLED SODIUM ALKYLPOLY(OXYETHYLENE) SULFATES IN 35 CARP (CYPRINUS CARPIO),
Tokyo Metropolitan Research Inst. for Environmental Protection, Tokyo (Japan).
M. Kikuchi, M. Wakabayashi, H. Kojima, and T. Yoshida.
Water Research, Vol 14, No 10, p 1541-1548, October, 1980. 6 Fig, 3 Tab, 9 Ref.

Descriptors: *Toxicity, *Surfactants, *Carp, Aquatic life, Metabolism, Fish physiology, Water pollution effects, Laboratory tests, Environmental effects, Water pollution, Detergents, Water pollution sources.

Surfactants present as pollutants in the aquatic environment are often accumulated by aquatic organisms. The uptake, distribution and elimination of radioactively labelled sodium dodecyltri(oxyethylene)sulfate (C-12-AES 3) and sodium dodecylpenta(oxyethylene)sulfate (C-12-AES 5) were studied in carp (Cyprinus carpio). Carp were exposed to concentrations of 0.3-0.6 milligrams/liter of the compounds during the various experiments. Levels of detergents were measured by whole-body autoradiography and liquid scintillation counting. Rapid absorption of the compounds occurred via the gills and skin. After 24 hours of exposure, high levels of radioactivity were noted in gills, hepatopancreas, gall bladder, intestinal content and oral and nasal cavities. Similar distribution patterns for C-12-AES 3 and C-12-AES 5 were observed. Carp whole body concen-

tration factors after 72 hours of exposure were calculated to be 18 for C-12-AES 3 and 4.7 for C-12-AES 5. The absorbed radioactivity was eliminated more rapidly from fish exposed to C-12-AES 3 than to C-12-AES 5 in surfactant-free water, with elimination from the gills and hepatopancreas proceeding more rapidly than that from the gall bladder. (Geiger-FRC)
W81-00948

INFLUENCE OF WATER HARDNESS ON CADMIUM TOXICITY TO SALMO GAIRDNERI RICH,
Istituto di Ricerca sulle Acque, Milan (Italy).
D. Calamari, R. Marchetti, and G. Vailati.
Water Research, Vol 14, No 10, p 1421-1426, October, 1980. 1 Fig, 4 Tab, 25 Ref.

Descriptors: *Hardness, *Toxicity, *Rainbow trout, *Cadmium, Calcium, Heavy metals, Fish physiology, Water pollution, Laboratory tests, Lethal limits, Theoretical analysis, Chemical properties.

The effects of water hardness as well as the chemical species of metals on the acute toxicity of cadmium (Cd) to rainbow trout were examined in laboratory tests. The acute toxicity of Cd to trout was increased by reducing water hardness. The theoretical distribution of the chemical species of Cd in water of different levels of hardness at pH 7.2 was determined. Different levels of mortality were observed in fish exposed to similar concentrations of Cd in the same form. Different amounts of ionic-form Cd gave similar acute toxic effects. When fish acclimated at 320 milligrams CaCO3/liter were tested at 20 milligrams CaCO3/liter, an intermediate toxic effect was noted, showing agreement with the biological hypothesis. The proliferation of chloride cells in gills often accompanies exposure to toxic levels of metals. Fish exposed to hard water would normally contain a larger number of these cells, thereby making them more resistant to the toxic actions of Cd. Fish maintained in waters of a variety of hardnesses had different ionic contents in the blood, but the same number of chloride cells in the gills. Therefore detoxification schemes based mainly on the increase in chloride cells should be independent of hardness and show more relation to the presence of metals. However, some findings indicate the toxic action of Cd depends upon water hardness as a regulator of gill permeability. (Geiger-FRC)
W81-00949

AN APPROACH TO CHEMICAL AND BIOLOGICAL RIVER MONITORING SYSTEMS,
Southern Water Authority (England).
A. D. Hamer, and P. G. Soulsby.
Water Pollution Control, Vol 79, No 1, p 56-69, January, 1980. 5 Fig, 4 Tab, 30 Ref.

Descriptors: *Rivers, *Monitoring, *Reviews, *Water quality, *Bioindicators, *Water quality standards, Mathematical studies, Model studies, Water pollution control, Water pollution treatment, Sewage treatment, Fluctuations, Aquatic animals, Invertebrates, Biological communities, Water quality control, Diurnal, Streams.

New guidelines for the chemical and biological monitoring of river water are outlined to comply with quality objectives of the Water Act of 1973 and the Pollution Act of 1974. Chemical monitoring of a river is usually done to establish the long-term quality of the system, for pollution control and investigation, or for water quality monitoring. Quality monitoring should be done at frequent intervals; however, usually sampling is only done on a monthly basis. Mathematical evidence is presented to indicate the importance of obtaining an adequate number of samples to ensure accurate data. The effects that a particular discharge might have on the flora and fauna of the receiving stream are of particular importance in pollution investigations. The effects of diurnal fluctuations in effluent flows are considered in relation to sewage treatment works. Water quality modeling used a simple mass balance equation as a mathematical model. As yet, criteria have not been established for the biological surveillance of river water quality through the study of microinvertebrates. Problems of sampling and data analysis in biological monitoring are reviewed. Other data analysis techniques often used in biological studies include multivariate techniques, ordination, clustering, abundance categories, and community schemes. Taxa are characterized in an unpolluted Upper Chalk stream and an unpolluted tertiary stream to illustrate the application of principal component analysis, a multivariate technique, over a three year period. It was suggested that, regardless of costs, chemists as well as biologists take appropriate measures to gain the skills which will be needed for successful water quality monitoring in the future. (Geiger-FRC)
W81-00952

MICROBIAL DYNAMICS OF TWO SUB-ARCTIC CANADIAN RIVERS,
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences.
L. J. Albright, K. V. Masuda, G. L. Ennis, and H. Schreier.
Water Research, Vol 14, No 9, p 1353-1362, September, 1980. 8 Fig, 6 Tab, 30 Ref

Descriptors: *Rivers, *Sub-Arctic, *Aquatic productivity, *Microorganisms, Canada, Algae, Primary productivity, Ice breakup, Bacteria, Plankton, Standing crops.

Microalgal and bacterial biomasses and activities of two sub-Arctic rivers, Ogilvie and Swift Rivers, were greatest in spring and summer with decresing values noted through fall and winter. The data obtained suggests that light and dissolved organic carbon may be the major factors controlling standing crops and activities of microalgae and bacteria respectively. In late fall and winter, the phytoplankton and bacterioplankton were observed to be under greater physicochemical stress as compared to spring and summer. Microorganisms were more productive in the Ogilvie River than in the Swift River during all seasons. The authors suggest that the difference in productivity was due to the greater levels of total inorganic carbon and dissolved organic carbon found in the Ogilvie as compared to the Swift River at equivalent times of the year. (McKeon-FRC)
W81-00956

AVOIDANCE RESPONSE OF RAINBOW TROUT (SALMO GAIRDNERI) TO SINGLE-DOSE CHLORINATION IN A POWER PLANT DISCHARGE CANAL,
Wisconsin Electric Power Co., Milwaukee. Environmental Dept.
P. D. Schumacher, and J. J. Ney
Water Research, Vol 14, No 6, p 651-655, June, 1980. 3 Fig, 2 Tab, 23 Ref.

Descriptors: *Toxicity, *Rainbow trout, *Chlorination, *Fish behavior, *Electric powerplants, *On-site tests, Canals, Lethal limits, Chlorine, Water pollution, Water treatment, Statistics, Distribution patterns, Analytical techniques, Lake Michigan, Effluents, Discharge, Thermal pollution, Water pollution sources, Aquatic animals.

The use of chlorination to control biofouling in stream electric plants may not affect aquatic life if avoidance responses to chlorine are practiced. The initial avoidance responses of rainbow trout (Salmo gairdneri) to single-dose chlorine additions in a power plant discharge canal were examined as a function of chlorine concentration and total exposure. Trout were exposed in a cooling water discharge canal of Wisconsin Electric Power Company's Lakeside Plant on Lake Michigan to chlorine additions designed to achieve maximum total residual chlorine (TRC) levels of 0.04, 0.2, 0.6, and 1.0 milligrams/liter. The first retreat of trout from the chlorine front was observed at 0.05 milligrams/liter TRC. About 95% of the trout moved downstream at 0.5 milligrams/liter TRC. Fish retreated from the exposure area well before cumulative time-dose exposure approached lethal limits. The decrease in percentage of fish near the discharge was linear with increasing TRC levels. It was suggested that complete evaluations of the use of the avoidance response must take into account trout distribution throughout chlorination and the chance for repeated exposures. (Geiger-FRC)
W81-00957

LONG-TERM EFFECTS OF PCB (CLOPHEN A50) ON GROWTH, REPRODUCTION AND SWIMMING PERFORMANCE IN THE MINNOW, PHOXINUS PHOXINUS,
National Swedish Environment Protection Board, Studsvik. Brackish Water Toxicology Lab.
B-E. Bengtsson.
Water Research, Vol 14, No 6, p 681-687, June, 1980. 4 Fig, 4 Tab, 31 Ref.

Descriptors: *Toxicity, *Fish behavior, *Minnows, *Fish reproduction, *Polychlorinated biphenyls, Pollutants, Water pollution, Fish toxins, Fish diets, Spawning, Laboratory tests, Fish physiology, Growth rates, Aquatic animals, Gas chromatography, Temperature, DDT, Chlorinated hydrocarbon pesticides, Pesticides.

The long-term sublethal effects of Clophen A50, a mixture of more than 50 polychlorinated biphenyl compounds (PCB), on the minnow (Phoxinus phoxinus) were examined in laboratory tests lasting 300 days. PCB's have been found as contaminants of many natural waters, and their toxicity to various aquatic organisms has been documented. In the present study, mortality, growth, swimming performance and reproduction were studied in minnows fed 20, 200 or 2000 micrograms PCB/g food (dry weight) for 40 days. Clophen A50 was found to promote the growth of minnows. Uptake of PCB residues varied between 22 and 36% upon gas chromatographic analysis of fish tissues. Mortality rate was very slow for all groups, but began to accelerate towards the end of the experiment At the highest dose level, PCB delayed spawning and significantly reduced egg hatchability. Hatching times were significantly reduced in fish fed the medium and high doses of PCB. Effects of temperature upon hatchability and of egg formation and spawning on PCB body residues are also considered. No effects due to PCB were observed on swimming performance. (Geiger-FRC)
W81-00958

CONTAMINATION OF FRESH WATER AQUIFERS BY OIL SPILLS,
Department of Energy, Morgantown, WV. Morgantown Energy Technology Center.
For primary bibliographic entry see Field 5B.
W81-00963

CELLULAR BIOASSAY OF FISH AS A SENSITIVE INDEX OF WATER QUALITY RELATED TO MINE WATER,
West Virginia Univ., Morgantown. Water Research Inst
D. E. Hinton, and E. R. Walker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-149742, Price codes: A07 in paper copy, A01 in microfiche. Technical Completion Report, 1980. 139 p, 59 Fig, 9 Tab, 74 Ref. OWRT-A-037-WVA(1), 14-34-0001-0152.

Descriptors: *Acid mine water, *Water pollution effects, *Fish, *Bioassay, *Water quality, Analysis, Analytical techniques, Cytological studies, Coal mine wastes, Methodology, Mine water, Trace elements, Water quality standards, Chemical analysis, Evaluation, Metals.

The overall objective was to develop a cellular bioassay useful in determining the effects of constituents of mine water (acid, pH, and metals) upon tissues and enzymes of freshwater fishes and to determine, via biological criteria, water quality Coal-associated polynuclear aromatics caused induction of drug metabolizing enzymes in fish Mn(++) caused enhanced metabolism of benzo (a) pyrene in-vitro but was inhibitory under in-vivo conditions in rainbow trout. Particulate iron (Fe2O3) suspended in aquarium water and Mn(++) caused gill alterations. Most subtle changes involved swelling of surface epithelial cells (both metals) and appearance of phagocytic cells in secondary lamellae (Fe2O3) Mn(++) caused a reduction in the surface microridge pattern of gill epithelia. A quantitative morphometric

evaluation of control and acid-stressed (pH 4.0 or 5.0 by addition of H2SO4 to aquarium water) bullhead catfish showed a two-fold increase in the number of skin mucous cells of exposed fish, which was associated with an equivalent increase in volume density of skin mucosubstances. The three individual components of mine waters produced alterations which were easily differentiated from those produced by other agents and constitute evidence that cellular bioassay of target tissues in exposed fishes may yield valuable information relative to water quality.
W81-00980

ECOLOGICAL RESPONSE TO RELAXATION OF SEWAGE STRESS OFF SAN ISLAND, OAHU, HAWAII,
Hawaii Univ., Honolulu.
S. J. Dollar.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-135436, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, University of Hawaii, Honolulu, Technical Report No 124, March, 1980. 84 p, 34 Fig, 2 Tab, 28 Ref, 2 Append. 14-34-0001-9013.

Descriptors: *Benthos, *Reefs, *Coral, *Ecology, Sewage effluents, *Hawaii, Speciation, Macrobenthos.

The largest domestic sewage outfall in Hawaii discharged 3 cu m/s (62 mgd) of raw sewage in 10 m of water approximately 1,000 m off Sand Island, Oahu, from 1955 to 1977. Results of an ecological field study of epibenthic communities in proximity to Sand Island conducted in 1975 and 1979 show clear patterns of community change associated with both sewage impact and relaxation of this stress; negative community effects attributable to sewage input decreased, and degree of recovery of community structure increased with distance from the point source of discharge. Sewage discharge had an impact of up to 5,000 m west and 1,900 m east of the outfall. This elliptical area of influence is assymetrical to the west due to the prevailing current pattern which carried the sewage-laden plume to the southwest. Following sewage abatement two distinct zones of impact are distinguished by the degree of physical degradation of the benthic reef structure. A high impact zone extending some 500 m east and 1,000 m west of the outfall is now characterized by a complete biochemical reduction of the reef structure to a pitted, flat carbonate pavement covered presently with sediment-bound algal turf and few benthic faunal colonizers. In the zone of intermediate impact the old reef framework is largely intact, though devoid of most living corals. Instead a veneer of encrusting coralline algae covers most of the reef framework. Patterns of occurrence and diversity of reef fish show characteristics of response to sewage stress similar to attached invertebrates except that the area of influence is of much smaller extent. (Author's abstract)
W81-00983

ROLE OF SEAGRASSES IN ESTUARINE SYSTEMS,
Seattle Pacific Univ., WA. School of Natural and Mathematical Sciences.
R. C. Phillips.
In: Proceedings of the Gulf of Mexico Coastal Ecosystems Workshop, September 4-7, 1979, Port Aransas, Texas, Fore, P. L., and Peterson, R. D., Eds., Fish and Wildlife Service, Office of Environment, Report FWS/OBS-80/30, May, 1980, p 67-96. 1 Tab, 126 Ref, 1 Append. OCE 74-24358 A01.

Descriptors: *Marine plants, *Estuarine environment, *Seagrasses, *Ecology, Ecosystems, Water pollution effects, Salinity, Water temperature, Primary productivity, Cycling nutrients, Dredging, Aquatic animals, Eutrophication, Depth.

Owing to the protection from erosion they provide, their role in sediment accretion, and their high primary productivity, seagrasses are extremely important to coastal ecosystems. Estuaries typically support large seagrass meadows, and 80 to 90% of commercial and sport fishes depend on estuaries for part or all of their life cycle. Seagrasses appear to be euryhaline, with various species growing in waters of 6 to 60 parts per thousand salinity, and they tolerate a wide range of water temperatures. The depth distribution of seagrasses depends on interrelated factors: waves, currents, substrate, turbidity, and light penetration. Productivity, role in the food chain, nutrient cycling, and sediment stabilization are important ecological functions of seagrass meadows. Dredging poses the greatest threat to the seagrass ecosystem. Other hazards to seagrasses include eutrophication, temperature and salinity changes due to man's activities, wind and sea stress, population explosions, oil pollution, heavy metal pollution, and dumping of other toxic substances. Techniques for measuring the productivity of seagrasses are described in the appendix. (Moore-SRC)
W81-00995

ECOLOGY OF A HYPERSALINE LAGOON: THE LAGUNA MADRE,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
W. Pulich, Jr.
In: Proceedings of the Gulf of Mexico Coastal Ecosystems Workshop, September 4-7, 1979, Port Aransas, Texas, Fore, P. L., and Peterson, R. D., Eds., Fish and Wildlife Service, Office of Environment, Report FWS/OBS-80/30, May, 1980, p 103-122. 5 Fig, 2 Tab, 31 Ref.

Descriptors: *Estuarine environment, *Saline water, *Cycling nutrients, *Lagoons, *Ecology, Texas, Salinity, Marine plants, Detritus, Marine algae, Light penetration, Productivity, Water pollution, Seagrasses, Laguna Madre(TX).

A coastal Gulf of Mexico ecosystem, the Texas Laguna Madre represents one of only three oceanic hypersaline lagoons in the World. Salinity fluctuations between 30 and 60 per thousand now constitute a major feature of Laguna Madre. The overriding influence of salinity makes the Upper Laguna too unstable for biological succession, and consequently colonizing species persist. The Lower Laguna has showed shifts in species abundance in recent years. Environmental constraints have led to the dominance of three monotypic plant habitats: seagrass beds, algal mat communities, and drifting seaweeds. While the species distribution of benthic plants in the Laguna Madre is attributable to the general salinity conditions, the abundance of seagrasses in the Upper Laguna may be traced to the water clarity and nutrient loading effects. The combination of low nutrient input, but high primary and secondary production of the Upper Laguna indicates the efficiency of the nutrient cycling process there. Any activity which opens the system to flushing would cause significant impact on cycling of nutrients from detritus. The accumulation of pollutants in the Laguna also presents a real threat to sustained productivity. Pollutants such as pesticides and metals, drained from Rio Grande Valley agricultural and residential areas certainly are changing the Lower Laguna today. (Moore-SRC)
W81-00997

MANAGING IMPACTS OF PETROLEUM DEVELOPMENT IN BRACKISH MARSHES,
General Land Office of Texas, Austin.
W. Longley, and R. G. Jackson.
In: Proceedings of the Gulf of Mexico Coastal Ecosystems Workshop, September 4-7, 1979, Port Aransas, Texas, Fore, P. L., and Peterson, R. D., Eds., Fish and Wildlife Service, Office of Environment, Report FWS/OBS-80/30, May, 1980, p 157-174. 12 Ref.

Descriptors: *Oil fields, *Brackish water, *Coastal marshes, *Environmental effects, *Management, Exploration, Natural gas, Wetlands, Marsh management, Flow, Ecosystems, Hydrology, Canals, Levees, Roads, Construction, Texas, Blaumont area(TX).

Petroleum exploration and extraction operations produce two obvious levels of ecological effects in marsh ecosystems. The first level involves the radical change or complete removal of a given parcel of the system. Unrestrained growth and development of an oil field maximizes habitat fragmentation, which can radically alter the ecological character of the ecosystem. The second level of effects occurs when threshold levels of critical linkages or components are reached, and the ecosystem changes noticeably. Water is the major factor in maintaining marsh systems. Brackish marshes and delta marshes characteristically receive inputs of both saline and fresh water, although not in equal proportions. The movement of water through the system is the important force driving and controlling the wetlands. Because roads, levees, and canals alter water flows, they are considered to be the source of the most important impacts at the ecosystem level. Methods of reducing significant impacts from oil and gas operations can be catergorized as: minimizing total habitat losses during each phase of petroleum activities; maintaining adequate major water flows for the particular wetland ecosystem; and providing for restoration of landforms and conditions after petroleum operations have terminated. (Moore-SRC)
W81-00998

5D. Waste Treatment Processes

OPTIMAL PERIODIC CONTROL OF ACTIVATED SLUDGE PROCESSES: II. COMPARISON WITH CONVENTIONAL CONTROL FOR STRUCTURED SLUDGE KINETICS,
Houston Univ., TX. Dept. of Chemical Petroleum Engineering.
S. Y. S. Yeung, D. Sincic, and J. E. Bailey.
Water Research, Vol 14, No 1, p 77-83, January, 1980. 5 Fig, 2 Tab, 8 Ref, 1 Append.

Descriptors: *Waste water treatment, *Activated sludge, *Mathematical models, *Automatic control, Kinetics, Biochemical oxygen demand, Flocculation, Microbial degradation, Organic loading, Design.

Optimal periodic control and conventional control of activated sludge are compared by means of mathematical models. Conventional control was defined as a steady-state base case design augmented by a regulating controller of a kind typically used for the activated sludge process. For two quite different examples, periodic control reduced effluent BOD and/or its variability relative to conventional control. The optimal periodic control for structured sludge kinetics can be substantially different from the Monod/decay result. This result has important implications. If minimization of effluent BOD is the objective, classical control may produce control manipulations that are nearly opposite to the most effective response. Since the structured kinetics are believed more accurately to reflect the true behavior of the system, use of Monod/decay kinetics must be viewed with caution in designing conventional or optimal periodic dynamic operational strategies. Since the structured model may behave approximately like the Monod model or much differently, depending upon its parameter values, accurate kinetic parameter identification for a particular process is important in designing operational approaches. (McKeon-FRC)
W81-00769

THE TREATMENT OF MALT WHISKEY DISTILLERY WASTE USING THE FUNGUS GEOTRICHUM CANDIDUM,
New Univ. of Ulster, Coleraine (Northern Ireland). School of Biological and Environmental Studies.
J. P. Quinn, and R. Marchant.
Water Research, Vol 14, No 5, p 545-551, May, 1980. 3 Fig, 6 Tab, 23 Ref.

Descriptors: *Waste water treatment, *Fungi, *Cultures, *Biochemical oxygen demand, *Chemical oxygen demand, Carbon, Economic feasibility, Biomass, Proteins, Organic wastes, Industrial wastes, Whiskey distillery waste, Malt.

The effects of the imperfect fungus Geotrichum candidum in reducing the BOD, COD, and total organic carbon (TOC) of Irish malt whiskey distill-

ery waste are reported. When the fungus was grown in batch and in single and tow-stage continuous laboratory culture, a maximum BOD reduction of 92.2% was achieved. Maximum reductions of 80.6% and 75.6% were achieved for COD and TOC, respectively. When a two-stage continuous culture system was used, the fungal biomass removed from the second fermenter, when operated at a dilution rate of 0.125/hr, was found to have a true protein content of 45.5%. The economic prospects of using this process for waste treatment and perhaps as a source of single-cell protein seem encouraging. (McKeon-FRC)
W81-00772

DENITRIFICATION WITH METHANOL: MICROBIOLOGY AND BIOCHEMISTRY,
Natal Univ., Peitermaritzburg (South Africa). Dept. of Biochemistry.
G. R. Nurse.
Water Research, Vol 14, No 5, p 531-537, May, 1980. 5 Fig, 56 Ref.

Descriptors: *Water treatment, *Denitrification, *Mathematical models, Microbiology , Chemical reactions, Anaerobic bacteria, Nitrates, Activated sludge, Carbon, Biomass, Equations.

The development of a theoretical equation that adequately describes the stoichiometry of the denitrification of nitrate-polluted effluents with methanol is presented. Kinetic parameters previously reported have been for an unidentified biomass, as it was believed that the composition of bacterial species present in reactors was unimportant. However, denitrification with methanol results in selective enrichment of the genus Hyphomicrobium. Nitrate assimilation and respiration in inorganic nitrogen metabolism, methanol oxidation, and methanol assimilation are discussed. To develop the desired equation, the amounts of methanol and nitrate required to supply the total energy and reducing power requirements for the biosynthesis of cell material were determined. The energy requirement for 3-phosphoglycerate (3-PGA) and energy and reducing power requirements for synthesis of cells form 3-PGA with nitrate as nitrogen source and for synthesis of cells from methanol and nitrate were calculated as equations. From these, the equation 50.5 CH3H + 3 HN3 + 46.2 N3(-) yields 3 C4H72N + 38.5 C2 + 23.1 N2 + 46.2 H(-) + 68.9 H2 is derived. When the equation was used to calculate a theoretical growth yield (0.188 g cells/g methanol on an ash-free basis) or a consumptive ratio (1.31), the values obtained closely agreed with experimental values. This corresponds to experimental values of 0.195 g cells/g methanol with an ash content of 3.7% and a consumptive ratio of 1.30 plus or minus 0.06. The development of an equation describing the upper limit to the yield parameter is important for optimizing.
W81-00774

ESTIMATION OF NITRIFYING BIOMASS AND KINETICS IN WASTEWATER,
McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
E. R. Hall, and K. L. Murphy.
Water Research, Vol 14, No 4, p 297-304, April, 1980. 6 Fig, 4 Tab, 31 Ref.

Descriptors: *Waste water treatment, *Nitrification, *Microorganisms, *Nitrates, Nitrites, Kinetics, Bacteria, Oxidation, Tertiary treatment, Biomass.

A technique for in situ measurement of nitrogen oxidation rates in waste waters is described. An estimate of the nitrifying populations and their maximum specific substrate rates in the presence of heterotrophic organisms can be made by the direct addition of known quantities of pure nitrifiers to a mixed liquor sample, along with selective inhibition of Nitrosomonas activity. The design and modeling of combined carbon removal-nitrification systems for steady and dynamic loading conditions is made possible by knowledge of these parameters. Nitrogen oxidation was shown to be zero order for substrate and first order for microorganism concentration. Populations of nitrifiers in mixed liquor increased significantly with total Kjeldahl nitrogen loading. In addition, substantial changes were noted in maximum unit oxidation rates. This suggested a differential effect of heterotrophic organisms on nitrifying bacteria. (McKeon-FRC)
W81-00780

SIGNIFICANCE OF COD, BOD AND TOC CORRELATIONS IN KINETIC MODELS OF BIOLOGICAL OXIDATION,
West Pakistan Univ. of Engineering and Technology, Lahore.
J. A. Aziz, and T. H. Y. Tebbutt.
Water Research, Vol 14, No 4, p 319-324, April, 1980. 7 Fig, 1 Tab, 11 Ref.

Descriptors: *Biochemical oxygen demand, *Chemical oxygen demand, *Waste water treatment, *Organic loading, Correlation analysis, Model studies, Organic compounds, Biological treatment, Activated sludge, Oxidation, Mathematical studies, Kinetics, Sewage effluents, Domestic wastes.

At the Birmingham University, England, pilot plant for treating domestic sewage by activated sludge, correlations between COD, BOD, and total organic carbon (TOC) were analyzed at various stages of waste treatment. Automatic hourly collections were made over a 24-hr period from the influent to the aeration tanks and from the effluents from the final clarifiers. A significant correlation was found between COD and BOD for settled domestic sewage ($r = 0.747$, $p < 0.05$). As biological treatment proceeded, COD:BOD ratios of treated effluents increased, and no conclusively significant correlation between the parameters was found. BOD:TOC ratios decreased during treatment and were not significantly correlated in any filtered or unfiltered samples. Similarly, TOC was not satisfactorily related to COD. Studies of biological oxidation kinetic models revealed that these polluted assessment parameters are not interchangeable unless changes are made in the mathematical constants. Therefore, the indiscriminate interchanging of BOD, COD, and TOC in biological oxidation studies is not advisable. (Geiger-FRC)
W81-00784

AN EVALUATION OF PRETREATED NATURAL ZEOLITES FOR AMMONIUM REMOVAL,
Monsanto Research Corp., Dayton, OH. Dayton Lab.
J. R. Klieve, and M. J. Semmens.
Water Research, Vol 14, No 2, p 161-168, February, 1980. 1 Fig, 9 Tab, 22 Ref.

Descriptors: *Zeolites, *Ammonium, Water treatment, *Waste water treatment, Analytical techniques, X-ray diffraction, *Tertiary treatment, *Nutrient removal, Nitrogen compounds, Acids.

The results of laboratory studies on the evaluation of phillipsite, mordenite, erionite, and pretreated clinoptilolites for ammonium removal from wastewater are presented. Clinoptilolite's capacity for NH4(+) was not significantly affected by heat treatment (600C for 1 hr), but the zeolites capacity for NH4-N in the presence of competing cations was increased. The selectivity of clinoptilolite for ammonium was thus enchanced. Upon treating clinoptilolite with NaOH, its capacity for NH4-N using a pure solution of NH4Cl as feed was slightly improved, but the zeolite's selective capacity for NH4-N in the presence of competing cations was not affected. Acid (HNO3) and steam treatments did not influence clinoptilolite's capacity for NH4-N. Phillipsite's observed selectivity for ammonium was equal to clinoptilolite's, and its higher total capacity resulted in an effective capacity that was about double that of clinoptilolite on a weight basis. Unfortunately, phillipsite is structurally weak and breaks easily to produce fines, and it is about twice as expensive as clinoptilolite. If the strength of phillipsite could be improved with a binder it may become useful for water treatment. Erionite and mordenite removed ammonium poorly. (McKeon-FRC)
W81-00790

SOME DIMENSIONLESS PARAMETERS OF IMPELLER POWER IN COAGULATION-FLOCCULATION PROCESSES,
Agricultural Univ., Wageningen (Netherlands). Dept. of Water Pollution Control.
J. Leentvaar, and T. S. J. Ywema.
Water Research, Vol 14, No 2, p 135-140, February, 1980. 8 Fig, 3 Tab, 12 Ref.

Descriptors: *Waste water treatment, *Flocculation, *Coagulation, *Impellers, Colloids, Reynolds number, Pilot plant, Mixing, Treatment facilities, Mathematical studies, Domestic wastes, Velocity.

The effect of impeller and vessel geometry on impeller power dissipation was discussed. Particular attention was paid to square tanks as commonly used in coagulation-flocculation processes of waste waters. A pilot-scale dynamometer was used to measure dissipated energy into the water by the impeller as a function of revolutions/min. Four stirrers were used: a paddle, a small and a large two bladed propeller, and a turbine stirrer. The experiments showed that the dimensionless Power number for a square tank can be estimated by the Power number of a baffled cylindrical tank with distance between two baffles equal to the diameter of the square tank. The experiments showed a direct ratio between G value (average velocity gradient of the fluid) and another dimensionless number, the Reynolds number. When the dimensionless Power number was plotted as a function of the Reynold number on a log-log scale, it was found that at Reynolds numbers $> 1{,}000$, the dimensionless power number was constant for the square and cylindrical baffled tanks. Coagulation-flocculation experiments with mainly domestic sewage of the village of Bennekom indicated that the coagulation-flocculation performance for the removal of colloidal compounds at the same G value differed slightly with the stirrer type and type of vessel applied. The optimal G value was the same for all vessel-stirrer combinations. (McKeon-FRC)
W81-00791

UTILISATION, TREATMENT AND DISPOSAL OF DISTILLERY WASTEWATER,
Queensland Univ., Brisbane (Australia). Dept. of Chemical Engineering.
G. J. Sheehan, and P. F. Greenfield.
Water Research, Vol 14, No 3, p 157-277, March, 1980. 1 Fig, 9 Tab, 150 Ref.

Descriptors: Reviews, *Waste water treatment, Fertilizers, *Fermentation, Yeasts, *Alcohols, *Filtration, Biological treatment, Recycling, *Waste water disposal, Biomass, Nitrification, Denitrification, Sewage lagoons, Anaerobic digestion, Sludge treatment, Waste treatment, Activated sludge, Cultures, Trickling filters, Byproducts, Municipal wastes, Profit, Costs, Agriculture, Irrigation programs, Deep wells, Aquatic ecosystems, Toxicity, Environmental effects, Sewage effluents, *Distillery waste water.

Methods used in the treatment of distillery wastewater are reviewed. Distillery wastewater is usually comprised of a high volume of greatly acidic matter which presents many disposal and treatment problems. Waste streams generally contain high levels of both dissolved organic and inorganic materials. There has been increasing interest in the use of ethanol from biomass as a liquid fuel alternative. Ethanol fermentation is examined in relation to distillery wastes. Reducing the volume of wastes may be accomplished by fermenting higher strengths of molasses. Raw stillage discharge has a highly deleterious effect on fish life. Stillage has been proposed for use as a fertilizer, food supplement, biomass production agent, animal feed, and potash source. Physical-chemical treatment of stillage has met with little success. Anaerobic digestion, anaerobic filters, lagoons, activated sludge, trickling filters and rotating biological contactors have all been successfully applied to the treatment of stillage waste water. Pilot and full scale data is also available on the combined treatment of municipal wastes and stillage wastes. NaNO3 addition to stillage in shallow lagoons, followed by denitrification, has also been tried. (Geiger-FRC)

W81-00796

INVESTIGATION TO REPLACE THE CONVENTIONAL SEDIMENTATION TANK BY A MICROSTRAINER IN THE ROTATING DISC SYSTEM,
Stuttgart Univ. (Germany, F.R.). Inst. fuer Siedlungswasserbau und Wasserguetewirtschaft.
P-S. Cheung, K. Krauth, and M. Roth.
Water Research, Vol 14, No 1, p 67-75, January, 1980. 7 Fig, 6 Tab, 16 Ref.

Descriptors: *Waste water treatment, *Microstrainers, *Settling basins, *Suspended solids, Biological treatment, Filters, Rotating disc system, Effluents, Weather, Separation techniques, Tertiary treatment.

The efficiency of a microstrainer to remove suspended solids (SS) from the effluent of a rotating disc system was studied. The microstrainer (filter medium: polyester fiber fabric; filter surface area: 1.17 sq m) and a conventional sedimentation tank (surface area: 64 sq m) were run in parallel to compare the removal rates of each. Under dry weather flow conditions, the microstrainer removed about 95% of SS, achieving an effluent with about 8 mg/liter SS at a surface loading rate of up to 20 m/hr. The ability of the microstrainer to remove SS under wet weather flow conditions was slightly lower but still fell within acceptable limits. The microstrainer failed to effectively remove SS from the effluent of a partially treated biological system. Direct comparison between the efficiency of the microstrainer and of the conventional sedimentation tank showed that it was justified for the former to replace the latter in a rotating disc system with complete biological treatment. (McKeon-FRC)
W81-00797

STANDING PROUD. CONSISTENCY SPELLS SUCCESS AT SALT CREEK,
Salt Creek Drainage Basin Sanitary Dept., Villa Park, IL.
F. Dole, and J. Crosby.
Water and Sewage Works, Vol 127, No 10, p 18, 49, October, 1980. 2 Fig, 2 Ref.

Descriptors: *Treatment facilities, *Waste water treatment, *Sludge treatment, *Anaerobic digestion, Sludge, Dewatering, Drying, Aeration, Separation techniques, Sand, Filtration.

The wastewater treatment plant at Salt Creek, Illinois, is described. The plant effluent averages 1.48 mg/liter suspended solids and 1.79 mg/liter BOD, according to 1979 records. The activated sludge plant treats an average flow of 3 mgd. About 90% of the flow is domestic in nature. Raw sludge is pumped into one or two primary anaerobic digesters once or twice daily. For drying and dewatering there are 12 sand drying beds available and a belt filter press. An average of 25,000 gal/wk of sludge is pumped from the secondary digester to the sand drying beds or the belt filter press. At least an equivalent amount of supernatant is produced. Good liquid-solid separation is achieved in the secondary anaerobic digesters. Liquid drawn from secondary digesters is returned directly to the preaeration tanks, with the effluent going directly into the primary clarifiers. The return is at the rate of about 20 gpm. The supernatant is aerated with 2-3 ppm dissolved oxygen upon returning it to the primary treatment units. Close monitoring of raw sludge pumping, consistent temperatures throughout primary digesters, and consistent sludge drawoffs from the secondary digesters have produced the well-digested sludge reported at this plant. (Baker-FRC)
W81-00799

ROTATING DISC SEWAGE TREATMENT SYSTEM FOR SUBURBAN DEVELOPMENTS AND HIGH-DENSITY RESORTS OF HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
G. T. Griffith, R. H. F. Young, and M. J. Chun.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138349, Price codes: A05 in paper copy, A01 in microfiche. Project Completion Report, Technical Report No 116, May, 1978. 72 p, 22 Fig, 19 Tab, 43 Ref, 1 Append. OWRT-A-068-HI(2), 14-34-0001-7025.

Descriptors: *Sewage treatment, *Suburban areas, *Municipal wastes, *Hawaii, *Design criteria, Treatment, Waste treatment, Research and Development, Potential flow, Suspended solids, Wastes, Biochemical oxygen demand, Waste water(Pollution), Water Quality control, Water quality, Sewage systems, Sewerage, Sewage sludge.

Testing of this large-scale pilot rotating disc treatment system was carried out at the Honolulu Pacific Palisades Municipal Wastewater Treatment Facility to determine its treatment effectiveness and to provide design/operation criteria in domestic waste water treatment in Hawaiian/tropical climates. The system included primary clarification and sludge storage facilities, and a 1.8-foot disc diameter 225 sq ft four-stage rotating disc treatment unit. The test unit, evaluated at four hydraulic loadings (2.25-6.7) gallons per day per sq ft, achieved overall removal of carbonaceous BOD-5 and suspended solids of 94-82 and 96-82% when treating degritted raw domestic waste water. Peripheral rotational disc speed was held constant (1.0 foot per second) and waste water temperature of 27-28 degrees was used for the study. The disc section produced 0.40-0.50 mass units sludge per mass unit BOD-5 removed in the disc section. Installed rotating disc package systems treating sewage volumes of 25,000 and 100,000 gallons per day were estimated to be about 10% higher than for extended aeration and high-rate activated sludge package systems, but total annual cost over a 20-year period would be about 14 and 20% lower than these systems, respectively. (Zielinski-IPA)
W81-00801

INFLUENCE OF FULVIC ACID ON THE REMOVAL OF TRACE CONCENTRATIONS OF CADMIUM(II), COPPER(II), AND ZINC(II) FROM WATER BY ALUM COAGULATION,
New Hampshire Univ., Durham. Dept. of Chemistry.
R. E. Truitt, and J. H. Weber.
Water Research, Vol 13, p 1171 to 1177, 1979. 4 Tab, 33 Ref, OWRT-B-004-NH(5), 14-34-0001-8132.

Descriptors: Copper, Cadmium, Zinc, *Fulvic acid, *Water treatment, Ions, Water pollution, *Trace elements, *Coagulation, Separation techniques, Trace metals, *Alum coagulation, Metal ion removal, Coagulants.

The effectiveness of Cu sup 2+, Cd sup 2+ and Zn sup 2+ removal form solution by alum coagulation was measured with fulvic acid present and absent. A factorial experimental design and analysis of variance were used to determine the effect on metal ion removal of the individual variables pH, metal ion concentration, alum concentration and fulvic acid concentration and their combinations. The variable levels model water treatment plant conditions. Metal ion losses up to 96% for Cu sup 2+, 59% for Cd sup 2+ and 82% for Zn sup 2+ were measured in the preence of fulvic acid. In its absence the maximum metal ion losses observed were 93%, 14% and 53% for Cu sup 2+, Cd sup 2+ and Zn sup 2+, respectively. Fulvic acid enhances metal ion removal under most experimental conditions. The practical implication of the results is that strong complexes between natural water organic matter and metal ions enhance their removal by the alum coagulation process.
W81-00807

A FEW THOUGHTS ON WASTE,
National Building Research Inst., Pretoria (South Africa).
R. C. Jones.
The Certified Engineer (Johannesburg), Vol 52, No 3, p 382-386, March, 1979.

Descriptors: *Pollution abatement, *Waste disposal, *Management, *Optimization, *Social aspects, Technology, Methodology, Soil conservation, Waste dumps, Waste treatment, Water conservation, Water consumption, Water pollution control, Energy, Recycling, Rainfall, Desalination, Winds, Tides, Hydrogen, Hydroelectric power, Stream, Animal population, Vegetation, South Africa.

A challenge is presented to every one to decrease waste, recycle material, use what materials are available wisely and conserve what we have. A decrease in waste is economically feasible if it is applied correctly such as where refuse from one plant's operation is used as the raw material for another. Water recycling and conservation is particularly critical in South Africa because consumption will surpass the amount of rainfall by 1986. More water can be obtained by desalination of seawater and purification of effluent water by plants such as the water hyacinth. The nutrients in the soil must be maintained and the amount of gaseous wastes decreased in the air. New and old sources of energy must be found and rediscovered such as hydrogen, hydroelectric power, stream, sunlight, wind, tides, and lightening. Indigenous animal populations which are good protein producers should be fully exploited. The potential for human ingenuity and talent development remains the key to responsible waste management and a productive society. (Sidney-IPA)
W81-00812

PERFORMANCE OF AEROBIC DIGESTION AT DIFFERENT SLUDGE SOLID LEVELS AND OPERATION PATTERNS,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
J. Ganczarczyk, M. F. Hamoda, and H-L. Wong.
Water Research, Vol 14, No 6, p 627-633, June, 1980. 9 Fig, 3 Tab, 18 Ref.

Descriptors: *Activated sludge, *Suspended solids, *Laboratory tests, *Sludge digestion, Aerobic digestion, Volatility, Sewage treatment, Continuous flow, Biological treatment, Operations, Waste water treatment, Degradation, Sludge treatment.

Laboratory batch and semi-continuous experiments were conducted to clarify the relationship between the digestion performance and the level of solids in the aerobic digestion process, to study the operation patterns of aerobic digestion, and to compare the effectiveness of aerobic digestion of both the primary sewage sludge and the waste (excess) activated sludge. Aerobic digestion of primary sludges and waste secondary activated sludges was carried out at 20 degrees with solids concentrations of 60,000 milligrams/liter and 20,000 milligrams/liter, respectively. Results showed that aerobic digestion of more concentrated sludges was associated with slower solids degradation rates. However, in the range of concentrations tested, the more concentrated sludges yielded greater masses of volatile suspended solids decomposed per unit digester volume per day. The amounts of volatile suspended solids decomposed per unit digester volume per day were similar for the primary and secondary sludges with the same volatile suspended solids concentration. Results of batch digestion tests were not directly applicable to the design of continuous flow aerobic digesters. It was also found that sludge treatment by a higher level of solids could be used to obtain a more stabilized sludge product. (Geiger-FRC)
W81-00865

FLOC-FORMING SUBSTANCES EXTRACTED FROM ACTIVATED SLUDGE BY SODIUM HYDROXIDE SOLUTION,
Gifu Coll. of Pharmacy (Japan). Dept. of Environmental Hygiene.
T. Sato, and Y. Ose.
Water Research, Vol 14, No 4, p 333 to 338, April, 1980. 1 Fig, 5 Tab, 37 Ref.

Descriptors: *Activated sludge, *Sewage bacteria, *Flocculation, *Separation techniques, *Chemical analysis, Proteins, Carbohydrates, Metals, Hydrogen ion concentration, Spectrophotometry, Analytical techniques, Sodium hydroxide, Slime, Viscosity, Gas chromatography, E. coli.

The viscous substance which has been implicated as the cause of floc formation in activated sludge

and is produced by sludge bacteria was extracted from activated sludge with 2 N and 0.1 N NaOH solutions by a modified method of Tezuka. The resultant NaOH extracts flocculated kaolin and E. coli suspensions at pH values below 3. Substances extracted from E. coli with 2 N NaOH solution did not flocculate the suspensions of kaolin in any pH range. The 2 N NaOH extract yielded 4.55%, while the 0.1 N NaOH extract yielded 1.12% of viscous substance. The chemical compositions of these extracts were determined after elemental and gas chromatographic analyses and tests for protein, carbohydrates, RNA, DNA, and sugars. Paper chromatography, color reactions of uronic acid, and determinations of metals in the ash by atomic absorption emission spectrophotometry were also carried out. Results showed that extracts contained protein, carbohydrates, nucleic acids and ash. The carbohydrate components contained the sugars arabinose, mannose, galactose, glucose, amino sugar and a few other sugars. Among the 11 metals found in the sludge extracts, Na, Fe, Ca, and K were present in larger amounts. (Geiger-FRC)
W81-00869

STUDIES ON THE USE OF INORGANIC GELS IN THE REMOVAL OF HEAVY METALS,
Roorkee Univ. (India). Dept. of Chemistry.
S. K. Srivastava, G. Bhattacharjee, A. K. Sharma, and C. K. Oberoi.
Water Research, Vol 14, No 2, p 113-115, February, 1980. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Waste water treatment, *Heavy metals, *Gels, Separation techniques, Ion exchange, Sorption, Iron, Cobalt, Zinc, Silver, Cadmium, Mercury, Thallium, Inorganic compounds.

Investigations are reported on the sorption and recovery of some heavy metal ions on columns using inorganic gels as exchanger material. Chromium ferrocyanide gel demonstrated a great affinity for Ag, Cu, Tl, Zn, Co, Cd, Mn, and Fe ions. The only drawback seen to using this type of column is the limited recovery of only a few metal ions such as cobalt, cadmium, manganese, zinc and lead. Silver and copper are irreversibly taken up. Even so, the method can be used to separate these metal ions from waste water in the presence of other salts and high acidity. (Baker-FRC)
W81-00872

FULL-SCALE PHYSICAL-CHEMICAL-BIOLOGICAL TREATMENT OF TEXTILE WASTEWATERS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
C. W. Randall, and P. H. King.
Progress in Water Technology, Vol 12, No 3, p 231-238, 1980. 4 Fig, 4 Tab.

Descriptors: *Biological treatment, *Aeration, *Industrial wastes, *Textiles, Waste water treatment, Chemical oxygen demand, Biochemical oxygen demand, Suspended solids, Color, Sludge, Water purification, Water pollution, Organic compounds, Aeration lagoons.

The treatment of textile wastewaters by three full-scale plants was compared. Plant A was the simplest of the three plants; it consisted of only an extended activated sludge system plus sand drying beds. Plants B and C both had biological and chemical processes, with plant B placing the chemical system first and plant C placing the biological system first. Results showed that biological processes alone produced an inferior quality effluent in terms of organic matter, suspended solids, color, and total phosphorus. The best effluent in terms of biochemical oxygen demand (BOD) and total suspended solids (TSS) was plant C; however, plant B had a lower chemical oxygen demand (COD) and a lower color. Most of the BOD, but less than half of the COD and color were removed by the biological treatment of planct C. In plant B, less than 20% of the COD but over 90% of the color was removed by the biological processes. Both plants B and C had biological processes which increased the TSS. Plant B proved to be the most trouble-free operation, while plant C effected the highest removals of all wastewater constituents. (Geiger-FRC)
W81-00873

THE EFFECT OF PLANT CONFIGURATION ON SLUDGE BULKING,
Water Pollution Research Lab., Stevenage (England).
M. J. D. White, E. J. Tomlinson, and B. Chambers.
Progress in Water Technology, Vol 12, No 3, p 183-188, 1980. 4 Fig, 6 Ref.

Descriptors: *Activated sludge, *Settling velocity, *Mixing, Pilot plants, Aeration, Biological treatment, Dispersion, Kinetics, Model studies, Sedimentation, Microorganisms.

Many different factors control the performance of an activated sludge system. Two aspects of process design which may be employed to improve the settling properties of activated sludge, anoxic mixing and longitudinal mixing, were investigated in pilot studies and full-scale activated sludge aeration tanks. The incorporation of an anoxic mixing stage into the aeration tanks of conventional nitrifying activated sludge plants caused improvements in sludge settlability, which were attributed to a reduction in longitudinal mixing as well as the introduction of an anoxic environment. Chemical and radioactive tracer studies have shown that the degree of longitudinal mixing could be expressed as a dimensionless Dispersion Number. A correlation was noted between the Dispersion Number and the settling characteristics of the activated sludge, which was expressed as the Stirred Specific Volume Index. Sludges with better settling properties were produced by aeration tanks with lower Dispersion Numbers, because in tanks with higher Disperion Numbers, conditions of complete mixing were simulated. (Geirger-FRC)
W81-00874

FLOC SIZE, FILAMENT LENGTH AND SETTLING PROPERTIES OF PROTOTYPE ACTIVATED SLUDGE PLANTS,
Georgia Inst. of Tech., Atlanta, GA.
M. Sezgin, D. Jenkins, and J. C. Palm.
Progress in Water Technology, Vol 12, No 3, p 171-182, 1980. 5 Fig, 6 Tab, 7 Ref.

Descriptors: *Flocculation, *Activated sludge, *Model studies, *Settling velocity, Prototype tests, Microorganisms, Sewage bacteria, Biological treatment, Theoretical analysis, Laboratory tests, Waste water treatment, Sewage treatment.

The applicability of the relationship between total extended filament length and the settling characteristics of activated sludge to operating prototype treatment units was determined. The hypothesis that floc sizes in laboratory activated sludge units are smaller than in prototype units was also examined. Activated sludges from twelve California sewage treatment plants were used in the experiments. Results showed that settling properties of the activated sludge of full-scale plants after evaluation of reflocculation time, zone settling velocity, height of the 60-minute compact volume and sludge volume index were related to the total length of filamentous microorganisms using previous relationships developed for laboratory activated sludge units. In full-scale plant studies, the amount of filaments extending from the flocs had the greatest influence on settling properties of the activated sludge in both purely domestic and partially industrial sewage. No difference was observed in the mean maximum floc dimension between full-scale and laboratory-scale activated sludge treatment systems. (Geiger-FRC)
W81-00875

WASTE WATER FROM A CHEMICAL-PHARMACEUTICAL WORKS,
Boehringer, Mannheim (Germany, F.R.).
N. Reus, and H. Rueffer.
Progress in Water Technology, Vol 12, No 3, p 153-169, 1980. 11 Tab, 8 Ref.

Descriptors: *Biological treatment, *Industrial wastes, *Toxins, *Activated sludge, *Sewage bacteria, Waste water treatment, Water pollution, Sewage treatment, Chloroform, Solvents, Pilot plants, Organic compounds, Carbon tetrachloride, Nitrate.

The Boehringer Mannheim pharmaceutical company, which had formerly discharged about 40% of its wastewater into the Rhine River, was required in 1973 to discharge its wastes into a newly constructed municipal sewer. To reduce the load of oxidizable and noxious substances before discharge, several experiments were performed by the company to ascertain that effluents would not harm bacterial populations or sewer components. An adapted activated sludge was employed which was found to yield good biodegradability when mixed with sewage. The adapted sludge also functioned well in the presence of high levels of chloroform. All chlorinated hydrocarbons and solvents were decomposed by treatment processes in pilot plant tests. Step-by-step discharge of wastes was begun into the sewer in 1978 with no breakdown having occurred in the system up to the present time. The adapted sludge tolerated chloroform contents greatly in excess of acceptable toxicity levels. Controlled natural selection of sludge bacteria was also geared to handle carbon tetrachloride, methanol, nitrate and other toxic solvents. (Geiger-FRC)
W81-00876

COMPARISON OF COSTS OF FOUR MODIFICATIONS OF THE ACTIVATED SLUDGE PROCESS: AN EXAMPLE CASE,
Technische Hochschule, Vienna (Austria). Inst. fuer Wasserversorgung Abwasserreiningung und Gewasserschuts.
W. Floegl.
Progress in Water Technology, Vol 12, No 3, p 139-151, 1980. 8 Fig, 5 Tab, 5 Ref.

Descriptors: *Biological treatment, *Activated sludge, *Comparative costs, *Operating costs, Waste water treatment, Sludge digestion, Biochemical oxygen demand, Density, Human populations, Sewage treatment, Model studies, Theoretical analysis, Systems analysis, Annual equivalent costs.

Difficulties often arise in comparing costs of existing waste water treatment plants because of such external factors as location, overall economic situation of construction, plant equipment, safety features, and means of financing. To obtain a more objective comparison, four modifications of the activated sludge process with BOD5 effluents of less than or equal to 20 milligrams/liter were examined. The plant sizes covered population equivalents ranging from 50,000 to 500,000. The four modifications were: a one-stage activated sludge plant (a.s.p.) with primary treatment and sludge digestion; a one-stage a.s.p. without primary treatment, with sludge digestion; a one-stage a.s.p. without primary treatment, with simultaneous aerobic sludge stabilization; and a two-stage a.s.p. without primary treatment, with sludge digestion. Estimates were based on single cost positions to exclude external factors. Least expensive total annual costs were found with the one-stage type operation without primary treatment. Using a primary treatment alternative caused slight cost increases. Higher costs also occurred with an alternative with simultaneous aerobic stabilization and a two-stage alternative. (Geiger-FRC)
W81-00877

PRELIMINARY STUDIES ON COMBINED OR SEPARATE TREATMENT (AS EXPERIENCED WITH EFFLUENTS FROM INDUSTRIES PROCESSING WOOD),
Technische Hochschule, Vienna (Austria). Inst. fuer Wasserversorgung Abwasserreiningung und Gewasserschuts.
H. Fleckseder.
Progress in Water Technology, Vol 12, No 3, p 129-138, 1980. 13 Ref.

Descriptors: *Waste water treatment, *Sewage treatment, *Pulp and paper industry, *Cost analysis, *Theoretical analysis, Industrial wastes, Mathematical studies, Pulp wastes, Cost comparisons, Economics, Systems analysis, Model studies, Design, Wood wastes.

Qualitative and quantitative comparisons were made of five Austrian effluent treatment plants to evaluate the cost effectiveness and efficiency of the separate or combined approach to treatment of sewage and industrial effluents. One of the plants treated a fiberboard mill effluent, while the other four handled pulp mill effluents. The expected loads to each plant were assessed, and preliminary designs on connecting sewers were drawn up. Cost estimates were calculated, taking into account such variables as future plant expansions, urban development, and possible alternate discharge locations. It was recognized from these five cases that the appropriateness of combined or separate treatment of industrial wastes cannot be generalized and must take into account such individual factors as plant designs, management structures, topography, discharge schedules and regionalization. Although all five study sites favored combined treatment, it was suggested that cost evaluations be made for each individual plant under consideration. (Geiger-FRC).
W81-00878

INFLUENCE OF PHASE SEPARATION ON THE ANAEROBIC DIGESTION OF GLUCOSE-I. MAXIMUM COD-TURNOVER RATE DURING CONTINUOUS OPERATION,
Amsterdam Univ. (Netherlands).
A. Cohen, A. M. Breure, J. G. Van Andel, and A. Van Deursen.
Water Research, Vol 14, No 10, p 1439-1448, October, 1980. 7 Fig, 5 Tab, 41 Ref.

Descriptors: *Anaerobic digestion, *Chemical oxygen demand, *Fermentation, *Anaerobic bacteria, Sludge, Lipids, Separation techniques, Waste water treatment, Organic compounds, Acids, Sewage bacteria, Carbohydrates, Glucose.

An anaerobic digestion of a mineral medium containing 1% glucose was carried out in either one or two phases under similar conditions. The one-phase digestion system was comprised of an anaerobic up-flow with acidogenic and methanogenic populations to effect complete conversion of the carbon source into gaseous end products and biomass. The two-phase digestion system was composed of both an acid and a methane reactor in a series to permit sequential glucose acidogenesis and methanogenesis. Carbon mass balance was used to evaluate performance of the one-and-two-phase systems. Maximum turnover of COD was calculated by gradually increasing the feed supply of both systems. In the two-phase digestion process, maximum specific sludge loadings of the methanogenic phase were over 3 times greater than in the one-phase digestion system. In other experiments overloading was simulated with accumulation of volatile fatty acids. Propionate and acetate were formed in large quantities in the one-phase system, while accumulation of several fatty acids occurred in the two-phase system. After cessation of feed supply, only propionate remained in the one-phase system after one week and all fatty acids in the two-phase system were rapidly converted. The ecological and physiological importance of phase separation is also considered. (Geiger-FRC)
W81-00879

CONSTRUCTION ASPECTS OF OUTFALL DESIGN FOR GREATER ATHENS,
Hawksley (Watson), High Wycombe (England).
For primary bibliographic entry see Field 5E.
W81-00885

SEWAGE TREATMENT AND EFFLUENT DISPOSAL OPTIONS APPROPRIATE TO MEDITERRANEAN COASTAL DEVELOPMENTS AS STUDIED FOR GREATER ATHENS,
Hawksley (Watson), High Wycombe (England).
For primary bibliographic entry see Field 5E.
W81-00886

TRENDS IN COASTAL WASTE TREATMENT,
WAPORA, Inc., Chevy Chase, MD.
L. W. Olinger, and J. I. Bregman.
Progress in Water Technology, Vol 12, No 1, p 211-223, 1980. 4 Fig, 7 Ref.

Descriptors: *Monitoring, *Water pollution sources, *Waste water treatment, *Estuarine environment, *Sea water, Coasts, Costs, Regulation, Sewage effluents, Water quality, Sewage treatment.

American experiences in coastal water treatment are discussed, and their applicability to problems in the Mediterranean are briefly considered. The characteristics of estuarine and near-shore waters are presented including: tides, salinity, density, stratification, winds, bathymetry, and ecology. US laws and regulations which apply to waste water treatment facilities discharging into coastal areas are summarized. Advanced facilities of this type are described including water quality problems, annual or projected improvements in water quality, cost of the facility, and the economic impact of the facility on its users . The use of ocean outfalls for effluent disposal is examined including system design and effectiveness. Detailed water quality and biological studies of the receiving waters are recommended before construction of a costly advanced waste water treatment plant. A secondary treatment plant could be constructed on the site and monitored to see if this level of treatment is sufficient. Environmental monitoring programs should be used throughout the planning and treatment stages. (Small-FRC)
W81-00891

CONTROLLING ORGANIC COMPOUNDS IN WATER - BY TREATMENT,
T. Burke.
Water, No 34, p 17-19, September, 1980. 3 Fig, 3 Tab.

Descriptors: *Organic compounds, *Activated carbon, *Tertiary treatment, *Drinking water, *Adsorption, *Waste water treatment, Disinfection, Chlorination, Chlorinated hydrocarbon pesticides, Sewage treatment, Ozone, Public health, Costs, Water pollution treatment.

Possible health effects of synthetic organic compounds (SOC) in drinking water have necessitated changes in water treatment policies. The US EPA has passed laws limiting the level of trihalomethanes (THM) in drinking water to 0.10 milligrams/liter, and has required vulnerable utilities to install granular activated carbon (GAC) treatment processes. A variety of guidelines for safe levels of THMs in drinking water have been set by other nations. Control measures for limiting the level of SOCs and THMs in drinking water are reviewed. Studies in the United Kingdom were conducted to determine at which step of the treatment process efforts to limit THM formation should be concentrated. Alternatives to chlorine disinfection include ozonation and the use of chlorine dioxide. Flow diagrams are presented for typical GAC systems in a slow sand filtration plant and a chemical coagulation plant. The importance of selecting the correct carbon in treating different waters, and the costs of GAC absorption operations are considered. Research on SOC removal at the Water Research Center of the United Kingdom consists of desk, laboratory, and field studies. There remains no low cost solution to the removal of organic micropollutants in drinking water. Studies are also being conducted to ascertain the effects of low levels of organics in a variety of toxicity tests and epidemiological studies. (Geiger-FRC)
W81-00908

THE SECOND STAGE TREATMENT OF BIOLOGICALLY TREATED COAL CARBONIZING WASTES IN ADMIXTURE WITH SEWAGE,
Yorkshire Water Authority, Sheffields (England). Southern Div.
H. B. Tench.
Progress in Water Technology, Vol 12, No 3, p 221-230, 1980. 6 Tab, 2 Ref.

Descriptors: *Color, *Industrial wastes, *Sewage treatment, *Biological treatment, Waste water treatment, Rivers, Water pollution, Activated sludge, Mathematical studies, Model studies, Nitrification, Aeration, Adsorption, Water quality, Phenols, Iron compounds.

The further treatment of biologically treated coal carbonizing wastes by discharge to sewers was investigated in laboratory and full-scale tests. Carbonizing wastes were handled in admixture with sewage at levels of up to 20% in one aeration unit. Satisfactory performance was achieved if a sodium hydrogen carbonate buffer was added to increase the level of nitrification. Complex phenols produced a color in the carbonizing wastes which was not removed at the 20% additions. Ferric chloride treatment significantly removed the color in the effluent while serving as a sludge conditioner. When flocs occurred in the presence of the iron compound, most of the color was taken out by adsorption onto floc surfaces. Consent conditions for the discharge of the treated effluent by admixture with sewage established by the South Yorkshire Water Authority were aimed at permitting the survival of coarse fish. A simple mathematical model was proposed to calculate standards for discharge to a river or sewer. (Geiger-FRC)
W81-00911

ACTIVATED SLUDGE CONTROL IN THE SECONDARY SETTLING BASIN USING THE SLUDGE SETTLING ANALYZER,
Kanazawa Univ. (Japan). Dept. of Construction and Environmental Engineering.
S. Matsui, and N. Furuya.
Progress in Water Technology, Vol 12, No 3, p 213-220, 1980. 7 Fig, 1 Tab, 3 Ref.

Descriptors: *Activated sludge, *Instrumentation, *Mathematical models, *Settling basins, *Equations, Analytical techniques, Municipal wastes, Model studies, Waste water treatment, Monitoring, Overflow, Suspended solids, Automation.

A new instrument, the settling sludge analyzer, which was developed to monitor the settling interface of sludge and analyze sludge settling curves is described. The instrument was used to compute sludge volumes in the secondary settling basin according to a new mathematical model based on two previous theories. The sludge settling analyzer was applied to small and large size municipal waste water treatment facilities. Calculations produced by the new instrument gave good agreement with actual sludge volumes in the secondary settling basins. The sludge settling analyzer also computed relations among concentration of return sludge, MLSS, SVI, and overflow rate of the secondary basin based on the new formula and measurements of the sludge settling interface. The relations were found to be useful in predicting operating criteria for overflow rate, design, return sludge ratio, the level of MLSS in the activated sludge system and excess sludge withdrawal. (Geiger-FRC)
W81-00912

INVESTIGATIONS ON THE PERFORMANCE OF UPFLOW FINAL SETTLING TANKS IN ACTIVATED SLUDGE PLANTS,
Technische Univ., Munich (Germany, F.R.). Lehrstuhl und Pruefamt fuer Wasserguetewirtschaft und Gesundheitsingenieurwesen.
H. Resch.
Progress in Water Technology, Vol 12, No 3, p 201-211, 1980. 7 Fig, 1 Tab, 13 Ref.

Descriptors: *Activated sludge, *Settling basins, *Settling velocity, *Biological treatment, *Separation techniques, Sludge treatment, Pilot plants, Waste water treatment, Flocculation, Sewage treatment, Suspended solids, Effluents, Sedimentation, Structural shapes, Design, Germany.

In Germany, wastewater treatment processes characteristic of sludge blanket clarifiers are not considered, due to a preference for funnel-shaped final settling tanks with vertical upflow and 30% higher surface loadings. Activated sludge plants in Bavaria and Berlin which use Dortmund tanks for final settling were studied for surface loading, sludge return rate and levels of activated sludge. These 3 parameters were varied to examine their effect on effluent quality and distribution of suspended solids in the tanks. Additional studies were conducted in tube-shaped pilot settling tanks of the Ismaning plant to determine the influence of wastewater temperature, inlet depth, maximum loadings and

maximum sludge return rates on settling tank efficiency. The high load capacity of the Dortmund tanks was clearly demonstrated, while the effluent quality of the funnel shaped tanks with sludge blankets occurred with increased sludge volume loading. Effluent quality in the Dortmund tanks remained good provided sludge levels did not reach the water surface. (Geiger-FRC)
W81-00913

TREATMENT OF A FILAMENTOUS INDUSTRIAL WASTE IN A MUNICIPAL STEP AERATION PLANT,
Greeley and Hansen, Chicago, IL.
T. E. Wilson, G. Lukasik, and D. Ogle.
Progress in Water Technology, Vol 12, No 3, p 189-199, 1980. 5 Fig, 2 Tab, 2 Ref.

Descriptors: *Activated sludge, *Aeration, *Industrial wastes, *Biological treatment, *Microorganisms, *Suspended solids, *Water pollution sources, Waste water treatment, Municipal wastes, Settling velocity, Domestic wastes, Nitrification, Flocculation, Regulated flow.

A 12 mgd wastewater treatment plant employing a two-step, air activated sludge, nitrification process experienced serious problems when the aeration tank hydraulic and clarifier loading rates were increased sharply over the course of a start-up. Reduced treatment capacity occurred due to an increased number of filamentous organisms contributed by the effluent of an industrial wastewater treatment plant. Over a five day period during the course of the upset, this industry produced over 75% of the total influent suspended solids; it normally accounted for about 45% of the influent suspended solids. Plant process stability was regained and maintained by alterations in the first carbonaceous step and the aeration tank flow. Plug flow with no reaeration was replaced by a pattern in which 3 or 4 of the aeration passes were used for return sludge reaeration. Plant observations and test results of initial settling velocity showed that the treatment capacity of the municipal plant was related to the solids loading of the industrial wastewaters. (Geiger-FRC)
W81-00914

IMPLEMENTING PRETREATMENT REQUIREMENTS IN THE UNITED STATES: A STUDY OF FOUR PUBLIC AGENCIES TREATING DOMESTIC AND INDUSTRIAL WASTEWATER,
Lynam (Bart T.) and Associates, Chicago, IL.
For primary bibliographic entry see Field 6E.
W81-00916

THE EFFECT OF INTERNAL MASS TRANSFER RESISTANCES ON THE INTERPRETATION OF SUBSTRATE REMOVAL DATA IN THE SUSPENDED GROWTH SYSTEM,
Dorr-Oliver Inc., Stamford, CT.
W. K. Shieh.
Water Research, Vol 14, No 6, p 695-699, June, 1980. 4 Fig, 1 Tab, 14 Ref.

Descriptors: *Activated sludge, *Continuity equation, *Mass transfer, Theoretical analysis, Model studies, Kinetics, Flocculation, Mathematical studies, Separation techniques.

Suspended growth systems such as the activated sludge process are usually heterogeneous and autocatalytic, producing their own enzymes. A technical note is presented to theoretically demonstrate the significance of internal mass transfer resistances on the interpretation of the kinetic data of such systems. To examine these effects by the concept of an effectiveness factor, steady state conditions, simple soluble substrate, spherical microbial flocs with uniform size and composition, insignificant external mass transfer resistances and Monod kinetics were assumed. Three linearized plots used to evaluate kinetic constants were examined under cases of low and high ambient substrate concentrations. Large microbial floc conditions and low ambient substrate levels had a significant effect on the observed rate of the activated sludge process. The saturation utilization rate (k) in the Monod equation was not affected by internal mass transfer limitations when the Eadie-Hofstee and Lineweaver-Burk plots were used to determine kinetic parameters. Under the activated sludge suspended growth system, the three plots examined were not very sensitive to the effects of internal mass transfer resistances. (Geiger-FRC)
W81-00918

FIELD INFILTRATION AS A METHOD FOR THE DISPOSAL OF OIL-IN-WATER EMULSIONS FROM THE RESTORATION OF OIL-POLLUTED AQUIFERS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
H-O. Schiegg.
Water Research, Vol 14, No 8, p 1011-1016, August, 1980. 8 Fig, 1 Tab, 14 Ref.

Descriptors: *Potable water, *Aquifers, *Infiltration, *Oil spills, Water pollution, Retention, Model studies, Groundwater, Microbial degradation, Pumping, Path of pollutants, Emulsions, Jamin effect.

When oil accidents occur it becomes important to prevent permeation of the oil into aquifers that are used as potable water supplies. The use of water pumping to prevent the propagation of oil during a spill may result in oil-water emulsions with low oil content. Field infiltration of oil-water emulsions is often performed, with retention of oil by soil or its degradation by soil microbes. Field infiltrations use smaller amounts of fresh water than those required during pumping. It is also a simplistic and inexpensive technique. The major drawbacks of field infiltration are the uncertainty surrounding retention and the degree of microbial degradation of oil. The maximum retention capacity of oil due to the Jamin effect was investigated experimentally. Some hydromechanical principles of field infiltration by oil-water emulsions were also examined. The retention capacity for oil during infiltration of an oil-in-water emulsion at gravity flow rates was calculated to be definitely greater than the pendular saturation. The drop in the relative permeability of the wetting fluid was estimated to be even steeper after the retention of the non-wetting fluid by the Jamin effect than it was after a displacement. (Geiger-FRC)
W81-00920

LABORATORY STUDIES ON THE ADSORPTION OF ACRYLAMIDE MONOMER BY SLUDGE, SEDIMENTS, CLAYS, PEAT AND SYNTHETIC RESINS,
Plymouth Polytechnic (England). John Graymore Chemical Labs.
For primary bibliographic entry see Field 5B.
W81-00924

DISSOLVED AIR FLOTATION IN HOT WATER,
Department of Scientific and Industrial Research, Petone (New Zealand). Industrial Processing Div.
W. T. Shannon, and D. H. Buisson.
Water Research, Vol 14, No 7, p 759-765, July, 1980. 9 Fig, 2 Tab, 13 Ref.

Descriptors: *Flotation, *Thermal water, *Waste water treatment, Bubbling, Geothermal studies, Water pollution, Flocculation, Temperature, Iron, Dissolved oxygen, Industrial wastes, New Zealand.

The use of dissolved air flotation (DAF) in the treatment of hot geothermal wastewater and other hot industrial effluents was evaluated in an experimental rig at 50-90 degrees. The efficiency of air dissolution (by spraying water over proprietary packing), bubble size distributions, and the air-solids ratios necessary for iron floc flotation were similar at 80 degrees to values observed at ambient temperatures. Costs for the DAF saturation process were estimated to be comparable to those for ambient temperature systems due to reduced viscosity and density of the water at higher temperatures and increased water vapor pressures above 65 degrees. Tests on iron flocs yielded an 80% removal efficiency, which would be satisfactory in geothermal work at Wairakei, New Zealand. Bubble rise rates at 80 degrees were found to be three times faster than at 20 degrees. The onset of severe bubble coalescence at 80 degrees took place at air dissolution pressures above 350 kPa. (Geiger-FRC)
W81-00926

APPLICATION OF WATER EXTRACT OF BROWN COAL FLY ASH TO PHOSPHATE PRECIPITATION FROM POLLUTED WATERS,
Polish Academy of Sciences, Gdansk. Inst. of Hydraulic Research.
I. Kuziemska.
Water Research, Vol 14, No 9, p 1289-1293, September, 1980. 7 Fig, 4 Tab, 8 Ref.

Descriptors: *Chemical precipitation, *Phosphates, *Fly ash, *Coagulation, Alkalinity, Hardness, Suspended solids, Mathematical studies, Model studies, Municipal wastes, Waste water treatment, Eutrophication, Powerplants.

Brown coal fly ash taken from the Konin power plant was tested as a coagulant in a technique to precipitate phosphate from municipal wastes and strongly polluted water. Suspended solids were sedimented easily and improvements in BOD and COD were observed. A substantial amount of phosphate ion was precipitated immediately after the coagulant was introduced and after intensive mixing of the solution. Mathematical multiple regression models and experimental data have confirmed that the alkalinity and volume ratio of reacting waters and the total alkalinity of the tested water have the most significant influence on the degree of phosphate precipitation achieved. No effect on the process was found when reactant alkalinities in the range of 40 milliequivalent to 53 milliequivalent per liter were used. These two parameters enable 75% reliability in the prediction of phosphate ion precipitation from waters of known total hardness and alkalinity. (Geiger-FRC)
W81-00928

ON THE MECHANISM OF DEWATERING COLLOIDAL AQUEOUS SOLUTIONS BY FREEZE-THAW PROCESSES,
Columbia Univ., New York. Dept. of Chemical Engineering and Applied Chemistry.
G. Ezekwo, H-M. Tong, and C. C. Gryte.
Water Research, Vol 14, No 8, p 1079-1088, August, 1980. 7 Fig, 1 Tab, 40 Ref.

Descriptors: *Dewatering, *Sludge treatment, Freezing, Sewage sludge, Waste water treatment, Domestic wastes, Separation techniques, Crystallization, Analytical techniques, Solidification.

Freezing has been considered as an alternative to sludge dewatering and the conditions and extent to which the aqueous component in sludge can be solidified to ice were investigated. A partially digested sludge taken from the Coney Island Sewage Treatment Plant was subjected to a temperature gradient to -30 degrees. Crystal morphologies of freeze-dried samples were examined, thermal analyses were carried out, and water contents of drained gels were determined. Thermal analysis showed that about 50% water remained in the segregated solute matrix after freezing. Freezing of sludge resulted in the segregation of the solute, both dissolved and suspended, in a zone between the ice crystal domains. Dewatering was strongly dependent on retention of the form of the solute matrix during the melting process. To minimize the freezing time in potential freeze flocculation processes, the use of small particles was recommended. (Geiger-FRC)
W81-00931

NITROGEN TRANSFORMATIONS IN A SIMULATED OVERLAND FLOW WASTEWATER TREATMENT SYSTEM,
Louisiana State Univ., Baton Rouge. Lab. for Wetland Soils and Sediments.
R. L. Chen, and W. H. Patrick, Jr.
Water Research, Vol 14, No 8, p 1041-1046, August, 1980. 2 Fig, 6 Tab, 17 Ref

Descriptors: *Denitrification, *Nitrogen, *Model studies, *Overland flow, *Water purification, Nitrification, Municipal wastes, Industrial wastes, Waste water treatment, Adsorption, Nitrates, Nutrients, Water pollution.

Removal of pollutants by overland flow treatment has been suggested as an effective and economical technique for the purification of municipal and industrial waste water. It was proposed that a significant quantity of nitrogen could be removed by a properly planned nitrification-denitrification overland flow system. An overland flow test model was constructed to evaluate the efficiency of ammoniacal-nitrogen removal from waste water. Results showed removal of ammoniacal nitrogen, with the subsequent formation of nitrate. Radioactively-labeled nitrogen was used to examine nitrogen balance in the simulated overland flow system. Model studies revealed that the quantity of nitrogen removed depended upon denitrification rates. Nitrogen was absorbed by the soil, while applied ammoniacal nitrogen was assimilated by the vegetation. Ammoniacal nitrogen absorbed into the aerated soil surface mass underwent nitrification and was converted to oxidized forms of nitrogen. During subsequent wastewater applications, the nitrate diffused downward to the reduced zone, where some of it was denitrified to gaseous forms of nitrogen or was reduced to organic nitrogen by assimilation. The net loss of nitrogen which was observed in the overland flow system proved less than that predicted from non-labeled nitrogen mass balance estimations. (Geiger-FRC)
W81-00934

NITRIFICATION KINETICS IN ACTIVATED SLUDGE AT VARIOUS TEMPERATURES AND DISSOLVED OXYGEN CONCENTRATIONS,
Imperial Chemical Industries Ltd., Billingham (England). Dept. of Research and Development.
R. C. Charley, D. G. Hooper, and A. G. McLee.
Water Research, Vol 14, No 10, p 1387-1396, October, 1980. 8 Fig, 6 Tab.

Descriptors: *Nitrification, *Kinetics, *Activated sludge, *Dissolved oxygen, Model studies, Temperature, Domestic wastes, Sewage bacteria, Ammonia, Biochemical oxygen demand, Chemical reactions, Waste water treatment, Biological treatment.

Due to the growing concern over oxygen depletion by ammonia compounds in waste water, a study was undertaken to investigate the kinetics of nitrification under various temperatures and different levels of dissolved oxygen in activated sludge from a domestic sewage works. The effects of high concentrations of dissolved oxygen upon nitrifying bacteria were also studied in a 'Deep Shaft' effluent treatment process. The sludge was enriched with nitrifying bacteria by running a laboratory fermenter on ammonia supplemented sewage. Microbial nitrification kinetics were evaluated in respirometric studies. The reaction was found to be in agreement with the Michaelis - Menton model in the temperature range of 10-35 degrees. After acclimatization, high amounts of dissolved oxygen (38 milligrams/liter 02 at 30 degrees) had little effect on nitrification. However, the reaction was inhibited by nitrite levels in excess of 20 milligrams/liter. (Geiger-FRC)
W81-00937

MECHANISM AND KINETICS OF CYANIDE OZONATION IN WATER,
Amsterdam Univ. (Netherlands). Lab. of Chemical Technology.
J. A. Zeevalkink, D. C. Visser, P. Arnoldy, and C. Boelhouwer.
Water Research, Vol 14, No 10, p 1375-1385, October, 1980. 11 Fig, 4 Tab, 37 Ref.

Descriptors: *Ozone, *Mathematical studies, *Cyanide, *Oxidation, *Chemical reactions, Kinetics, Industrial wastes, Waste water treatment, Theoretical analysis, Laboratory tests.

The ozonation of potassium cyanide is of interest for its potential application in the treatment of cyanide bearing waste waters from industrial sources. The reaction has been studied in alkaline solutions buffered at a pH of 11.8 and a temperature of 20 degrees in a stirred tank reactor. The mass transfer parameters of the reactor have been determined by measuring the gas-liquid interfacial area and the physical mass transfer coefficient for different reaction condtions. Initial cyanide levels were about 100 grams/cubic meter. The reaction rate under these conditions may be described by an equation which is of first order with respect to ozone and independent of the levels of cyanide. Results of mass transfer studies showed that one mole of ozone oxidized one mole of cyanide; however, the reaction rate was so great that the conversion was limited by mass transfer. A reaction rate equation was predicted by the mechanism proposed for cyanide oxidation, and was supported by experimental data. The mechanisms proposed for the decomposition of ozone and the oxidation of cyanide were found to be similar. The kinetics proposed for the decay of ozone are in agreement with experimental data from the literature. (Geiger-FRC)
W81-00938

TYPE AND STRAIN DEPENDENCE OF ENTEROVIRUS ADSORPTION TO ACTIVATED SLUDGE, SOILS AND ESTUARINE SEDIMENTS,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
C. P. Gerba, S. M. Goyal, C. J. Hurst, and R. L. LaBelle.
Water Research, Vol 14, No 9, p 1197-1198, September, 1980. 1 Tab, 10 Ref.

Descriptors: *Viruses, *Adsorption, *Sediments, *Activated sludge, *Separation techniques, Soils, Suspended solids, Sewage effluents, Sea water, Waste water treatment, Laboratory test, Water purification, Sewage sludge, Loam, Sewage treatment.

The adsorption of enteric viruses to solids is believed to play an important part in their removal during sewage treatment processes. A study was conducted to determine if quantitative differences existed in the adsorptive behavior of different types and strains of enteroviruses toward surfaces known to influence their distribution in nature. Viral suspensions containing 1 to 10 million plaque-forming units were added to 1 to 10 grams of solids (soil, activated sludge or sediments) in either distilled water, sewage effluent or sea water. Solid:liquid ratios were 1:1, 1:140, and 1:7 for soil, activated sludge and sediment, respectively. Suspensions were mixed and then centrifuged, and the supernatants were assayed for viral content and compared with solid-free control preparations. Adsorption to solids was found to be dependent on virus type as well as strain. Great variability was seen in viral adsorption to soil, while little variation was noted in viral adsorptive behavior on estuarine sediments. Viral adsorption to solids is known to depend upon isoelectric point of the virus, which varies in different viral types and strains. Isotherm data for soil and sediments has also revealed different viral adsorptive capacities in these materials. These findings suggest that the type of solids present during sewage treatment may greatly influence the viral removal capacity of the process. (Geiger-FRC)
W81-00939

BIOLOGICAL TREATMENT OF A COAL GASIFICATION PROCESS WASTEWATER,
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
R. G. Luthy, and J. T. Tallon.
Water Research, Vol 14, No 9, p 1269-1282, September, 1980. 11 Fig, 5 Tab, 25 Ref.

Descriptors: *Industrial wastes, *Biological treatment, *Oxidation, *Organic compounds, *Waste treatment, Alkalinity, Waste water treatment, Chemical oxygen demand, Ammonia, Kinetics, Pilot plants, Sewage bacteria, Coal gasification waste water.

The efficiency of biological treatment on Hygas coal gasification process plant waste water was evaluated over an 8 month period. The waste water was composed of cyclone and quench condensates. The treatability of ammonia stripped and unstripped waste water at full strength and at 1:1 dilution was studied. The minimum pre-treatment needed for biological oxidation was calculated to consist of reducing the alkalinity and decreasing the raw ammonia level by dilution or stripping. Kinetic studies indicated that the waste water could be processed at mean cell residence times ranging from 10 to 40 days with 2 to 3 day hydraulic residence periods. The decay coefficient of Hygas wastes was 0.01/day, while the bacteriological yield coefficient was 0.10 on a chemical oxygen demand basis. Bacterial growth inhibition by Hygas waste water was attributed to short cell residence times. Although higher yield coefficients were achieved with diluted waste water, no problems with organic waste removal efficiencies were predicted under recommended processing parameters. (Geiger-FRC)
W81-00944

RESPONSE OF DISSOLVED OXYGEN TO CHANGES IN INFLUENT ORGANIC LOADING TO ACTIVATED SLUDGE SYSTEMS,
Vanderbilt Univ., Nashville, TN.
C. Y. Chen, J. A. Roth, and W. W. Eckenfelder, Jr.
Water Research, Vol 14, No 10, p 1449-1457, October, 1980. 8 Fig, 2 Tab, 14 Ref.

Descriptors: *Activated sludge, *Dissolved oxygen, *Organic compounds, *Biochemical oxygen demand, *Chemical oxygen demand, Monitoring, Respiration, Laboratory tests, Mathematical studies, Equations, Aeration, Model studies, Waste water treatment.

Responses of activated sludge to transient organic loadings and the effects of dissolved oxygen (DO) levels and oxygen uptake rates as control variables of the process were examined in a modified laboratory-scale activated sludge unit. The concentration of ambient dissolved oxygen was continuously monitored for changes due to the influent composition of the wastewater. While the system was kept in a steady state, system variables were measured for MLVSS (mixed liquor volatile suspended solids), soluble TOC (total organic carbon) and rate of oxygen uptake. By increasing or decreasing the baseline feeding of TOC level, organic shock loading was induced. When a transient loading took place, DO monitoring was accomplished with a DO analyzer. A material balance equation for DO in the system was formulated, and the dynamics of the oxygen uptake rate were investigated. Under transient conditions, the fluctuations in DO levels reflected changes in the exogenous respiration rate of the biomass in the system due to variations in the influent waste. Due to the rapid response to shock loading and the correlation between DO changes and the magnitude of shock loading, it was suggested that DO and oxygen uptake rate could be used as control variables for the activated sludge process. (Geiger-FRC)
W81-00946

TECHNICAL, ECONOMIC AND ENVIRONMENTAL ASPECTS OF WET AND DRY DEBARKING.
Water and Pollution Control, Vol 118, No 9, p 34, 36, September, 1980. 1 Ref.

Descriptors: *Wood wastes, *Waste water treatment, *Bark, Pulp wastes, Saw mills, Water pollution control, Industrial wastes, Costs, Suspended solids.

A summary of a report on waste water technology, including debarking processes, is presented. Wet and dry debarking operations are compared in terms of energy requirements, economics, product quality, and effect on manufacturing processes. A review is also presented of waste-water treatment alternatives representing technically feasible and economically viable systems which would permit the discharge or recycling of debarker waste water of acceptable quality. Systems using hydraulic jets, mechanical rings, wet drums, and dry drums in debarking arrangements were investigated. Varia-

bles that influence the efficiency of wet and dry debarking include the wood species, harvesting and debarking seasons, log quality, and storage methods. The projected cost of effluent control has been the major reason for both saw mills and pulp mills shifting from wet to dry debarking techniques. Savings roughly balance the additional costs. Current effluent treatment for wet debarkers is focused upon suspended solids removed. Improved techniques will be necessary for many wet debarkers to conform to present and projected future effluent regulations. (Baker-FRC)
W81-00954

EFFLUENT QUALITY VARIATION FROM MULTICOMPONENT SUBSTRATES IN THE ACTIVATED SLUDGE PROCESS,
Middle East Technical Univ., Ankara (Turkey). Dept. of Environmental Engineering.
S. Siber, and W. W. Eckenfelder.
Water Research, Vol 14, No 5, p 471-476, May, 1980. 8 Fig, 5 Tab, 13 Ref.

Descriptors: *Waste water treatment, *Activated sludge, *Mathematical models, *Total organic carbon, *Kinetics, Statistics, Suspended solids, Water quality, Analytical techniques, Biological degradation.

The authors tested the validity of mathematical models using three substrates (glucose, phenol, and sulfanilic acid) of widely differing removal rates in the activated sludge process. Sludge from a municipal sewage treatment plant was acclimated as a seed in a continuous flow, completely mixed laboratory reactor. A mixture of the three substrates in varying combinations was fed at different food/microorganism (F/M) ratios. Total organic carbon (TOC) was the parameter chosen to measure overall removal rates. Specific analytical measurements for each substrate in the influent and effluent samples were also made. Models relating the effluent quality in terms of soluble TOC to F/M or to sludge age were presented. The authors concluded from their studies that the overall substrate removal rate in terms of TOC was the sum of the individual substrate removal rates. The substrate removal rates were shown to decrease with increasing sludge age and decreasing F/M. The calculated and experimentally determined biodegradable fraction of the mixed liquor volatile suspended solids was shown to increase with increasing organic loading. (McKenon-FRC)
W81-00962

CONTAMINATION OF GROUND WATER SUPPLIES BY TRICHLOROETHYLENE--THREE CASE HISTORIES,
Weston (Roy F.), Inc., West Chester, PA.
W. J. Duffy, R. Moose, and S. J. Tomalavage.
In: Third Annual Madison Conference of Applied Research & Practice on Municipal & Industrial Waste, September 10-12, 1980, p 187-200. 3 Fig, 2 Tab. University of Wisconsin-Extension, Department of Engineering & Applied Sciences, 432 N. Lake Street, Madison, WI 53706.

Descriptors: *Water pollution control, *Organic compounds, *Groundwater resources, *Chlorides, Pennsylvania, Water pollution, Adsorption, Solvents, Industrial wastes, Trichloroethylene.

Clean groundwater is a resource that is rapidly becoming depleted in suburbanized areas throughout the United States, in part because of extensive contamination by organic solvents such as trichloroethylene (TCE) and methyl chloride (MC). Two important properties relating to groundwater contamination are specific gravity and solubility. Both TCE and MC are heavier than water and only slightly soluble; therfore, when spilled neither degrades but begins moving downward within the aquifer. Chlorinated hydrocarbons will remain stable in a subsurface environment essentially forever. Three programs in Pennsylvania to renovate groundwater resources show that while air-stripping is often a viable procedure, it cannot be used in all situations. Numerous other techniques to remove volatile hydrocarbons are available, such as adsorption of organic compounds by synthetic resins or activated carbon. However, maintenance costs and costs of disposal of used materials are problems associated with these technologies. Studies of these aquifers should be considered so that if subsequent contamination occurs, baseline data will be available to define and determine the contaminants. Monitored use of solvents within the industry, as well as increased public awareness of the problems created by use of these compounds, may prevent continued degradation of groundwater resources. (Garrison-Omniplan)
W81-00964

TREATMENT OF MILILANI STP EFFLUENT FOR DRIP IRRIGATION OF SUGARCANE,
Hawaii Univ., Honolulu.
E. K. F. Liu, and R. H. F. Young.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-144651, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of Hawaii, Honolulu, Technical Report No 128, July, 1979. 32 p, 13 Fig, 9 Tab, 19 Ref. 14-34-0001-9013.

Descriptors: *Waste treatment, *Water reuse, *Drip irrigation, *Sewage effluents, Return flow, Physicochemical properties, Sugarcane, Ditches, Irrigation systems.

The secondary effluent of the Mililani STP is intended for use in the drip irrigation of sugarcane. The relative success of this waste water reuse application is affected by the concentration of suspended solids in the sewage effluent. Chemical coagulation, dissolved air flotation, and granular media filtration were studied in the laboratory to determine the most cost-effective means of obtaining a sewage effluent with a suspended solids content similar to that of the water from Waiahole Ditch presently used in drip irrigation. Of the three methods tested, granular media filtration with anthracite coal-silica sand media at a flow rate of .001 7 cu m/s/sq m (2.5 gpm/sq ft) was a cost-effective method of producing a sewage effluent with suspended solids concentration in the range of that found in Waiahole Ditch water during dry weather. Model laboratory testing shows that application of this sewage effluent will not adversely affect the type of filter media used in drip irrigation. Preliminary analysis of the residual solids distribution found in the sewage effluent after this posttreatment shows that failure of the drip irrigation system due to excessive plugging should not be a problem. The estimated annual cost of this treatment system is $147,000 based on a 0.16 cu m/s (3.6-mgd) flow, or $40,830/mgd. (Author's abstract)
W81-00984

IRON REMOVAL BY ROTATING CONTACT REACTOR,
Missouri Univ.-Columbia. Dept. of Sanitary Engineering.
L. W. Tharpe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-144644, Price codes: A03 in paper copy, A01 in microfiche. Master of Science Thesis, May, 1979. 31 p, 8 Fig, 2 Tab, 16 Ref. OWRT-B-124-MO (3).

Descriptors: *Iron, *Water purification, *Water treatment, Equipment, Instrumentation, *Waste water treatment, Research and development, Ferrobacillus, Iron bacteria, Microorganisms, Water quality, Treatment, Quality control, Separation techniques, Impaired water quality, Waste water(Pollution), Evaluation, Testing, Rotors, Research equipment, Flow rates, Flow, Oxidation.

Feasibility assessment was made of using a rotating contact reactor to remove iron (Fe(II)) from water. Total soluble iron was determined using the Hach-Ferrozine method. The study was conducted in two phases: (1) determination of Fe(II) removal kinetics for the reactor at various flow rates, and (2) evaluation of the effect of disc surface area on overall Fe(II) removal. Hydraulic detention times less than fifty minutes reduced the percent removal of Fe(II) (from about 99%), according to a first-order (linear) relationship between Fe(II) removal and contactor stage detention time (slope: 2.13/minute). The rotating contactor could achieve 96-99% removal of total iron from a ferrous iron feed stream having a concentration up to 28 milligrams per liter. With eleven or six rotating discs, 99% Fe(II) removal was obtained; but this declined to 81% with all discs removed. Since stabilization of the rotating contactor after changing the flow rate was achieved in such short times (one day or less) relative to times required for biological systems (5-6 days), the oxidation and removal of Fe(II) was probably due to physiochemical activity. Rotation of the discs promotes aeration and mixing, and increases the efficiency of Fe(II) removal. (Zielinski-IPA)
W81-00985

5E. Ultimate Disposal Of Wastes

TRANSPORT OF POTENTIAL POLLUTANTS IN RUNOFF WATER FROM LAND AREAS RECEIVING ANIMAL WASTES: A REVIEW,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W81-00775

PROCESSES CONTROLLING VIRUS INACTIVATION IN COASTAL WATERS,
Harvard Univ., Cambridge, MA. Lab. of Microbial Ecology.
R. B. Kapuscinski, and R. Mitchell
Water Research, Vol 14, No 4, p 363-371, April, 1980. 2 Tab, 133 Ref.

Descriptors: *Water quality, *Viruses, *Marine bacteria, *Coasts, *Sewage effluents, Bacteriophage, Heavy metals, Suspended solids, Sludge disposal, Ultimate disposal, Coagulation, Solid wastes.

The biological, chemical, and physical processes that control virus inactivation in coastal waters are reviewed. An understanding of these processes is necessary for effective control of contamination in coastal waters used for human waste disposal. Evidence for a biological mechanism of dieoff comes from the isolation and identification of specific marine bacteria capable of inactivating viruses. However, their activity in the field is unknown Heavy metals have been implicated as being possibly virucidal in seawater, but the concentrations and complexes are not known. A thermal mechanism does not appear to be of primary significance, although temperature-correlated, seasonal variations in die-off rates have been reported. Laboratory experiments on virus adsorption predict that as much as 99% of the viruses present in coastal marine waters are adsorbed to naturally occurring colloidal and particulate matter. Other evidence indicates that viruses apparently survive longer in seawater in the adsorbed state. Laboratory studies of viral inactivation rates range from 1 to 43 days when expressed as the time required for 90% dieoff. These slow dieoff rates emphasize the need for more effective virus removal form sludge effluent. Increased control and efficiency of coagulation and sedimentation units for particulate and gross solids removal would appear to be one important step in controlling viral contamination of coastal waters. (McKeon-FRC)
W81-00788

CONSTRUCTION ASPECTS OF OUTFALL DESIGN FOR GREATER ATHENS,
Hawksley (Watson), High Wycombe (England).
K. D. Staples, and J. J. Guilfoyle.
Progress in Water Technology, Vol 12, No 1, p 245-261, 1980. 5 Fig, 5 Ref.

Descriptors: *Outfall sewers, *Project planning, *Feasibility studies, *Waste water disposal, Europe, Coasts, Construction, Construction costs, Engineers estimates, Municipal wastes, Sewerage, Athens, Mediterranean Sea.

The feasibility and cost of construction of marine outfalls for the disposal of liquid wastes from Athens were determined. A comprehensive data base is considered necessary and should include information about marine conditions, geological

and geotechnical conditions, local contracting capabilities, and engineering ability to assess all of the available data. Because of the low velocity of currents in the Mediterranean, a high degree of treatment is necessary before discharge. The hydraulic characteristics of the outfall and the diffuser design are presented. Possible outfall routes are proposed, and specific construction methods are discussed. Estimated costs are included for various proposals. (Small-FRC)
W81-00885

SEWAGE TREATMENT AND EFFLUENT DISPOSAL OPTIONS APPROPRIATE TO MEDITERRANEAN COASTAL DEVELOPMENTS AS STUDIED FOR GREATER ATHENS,
Hawksley (Watson), High Wycombe (England).
S. D. Myers, and C. M. Ainger.
Progress in Water Technology, Vol 12, No 1, p 225-244, 1980. 4 Fig, 6 Tab.

Descriptors: *Waste water disposal, *Project planning, *Outfall sewers, Coasts, Contract administration, Bids, Waste water treatment, Europe, Sewage disposal, Liquid wastes, Municipal wastes, Athens, Mediterranean Sea.

The characteristics and requirements of liquid waste disposal for the Athens area were determined. The most suitable and most economic method was that of a settled effluent discharged through along outfall. Other situations along the Mediterranean call for different solutions. Small developments far from the coast require high quality effluents for discharge on to land or to torrents. Developments which need additional facilities to meet the demands of tourists can adapt land-based treatment for these seasonal loads rather than invest in a long outfall system. Alternative treatment and disposal options should be considered carefully. If sedimentation/long outfall or chemically assisted sedimentation/short outfall systems are to be installed, they must be specified in the tender documents calling for turnkey bids. (Small-FRC)
W81-00886

LEACHATE COLLECTION USING THE GROUND-WATER FLOW SYSTEM: A LANDFILL CASE HISTORY IN CENTRAL PENNSYLVANIA,
Meiser & Earl/Hydrologists, State College, Pennsylvania.
E. W. Meiser, Jr., T. A. Earl, and R. M. Bodner.
In: Third Annual Madison Conference of Applied Research & Practice on Municipal & Industrial Waste, September 10-12, 1980, p 214-227. 7 Fig. University of Wisconsin-Extension, Department of Engineering & Applied Sciences, 432 N. Lake Street, Madison, WI 53706.

Descriptors: *Landfills, *Leachate, *Linings, *Waste storage, *Waste disposal, Pennsylvania, Waste treatment, Waste dumps, Clays, Lagoons, Disposal, Groundwater resources, Construction costs.

Waste disposal sites which rely on natural renovation of leachate in thick, suitably textured soils are becoming rare as regulations describing site requirements become more stringent. Fulkroad's Landfill in Pennsylvania is an example of a natural renovation landfill that meets Pennsylvania leachate treatment requirements. It is located on dissected rolling upland approximately 600 feet above sea level. The fundamental concept underlying the design is that groundwater flow in a shallow groundwater setting is upwards, converging on a definable discharge zone where leachate can be intercepted. The landfill area is restricted to a single groundwater basin. All the base flow is then collected into a groundwater interceptor drain system, and the cost of a liner is eliminated. The leachate treatment utilizes an aerated lagoon, a settling lagoon, a stream discharge in wet weather and spray irrigation discharge during dry months, with provisions for a future lime-addition system. Given the tight hydrogeologic setting, the authors conclude that this technique can perform reliably and safely. It is hoped that EPA's Resource Conservation and Recovery Act guidelines will be revised to permit a reevaluation of acceptable liners beyond the current requirement of several feet of low permeability clay---often a prohibitively expensive installation. (Garrison-Omniplan)
W81-00965

DISPOSAL OF LAKE SEDIMENTS CONTAINING ARSENIC,
Strand Associates, Inc., Madison, WI.
M. D. Doran, and M. A. Anderson.
In: Third Annual Madison Conference of Applied Research & Practice on Municipal & Industrial Waste, September 10-12, 1980, p 429-440. 5 Fig, 2 Tab. University of Wisconsin-Extension, Department of Engineering & Applied Sciences, 432 N. Lake Street, Madison, WI 53706.

Descriptors: *Lake sediments, *Sedimentation, *Dredging, *Water pollution, *Arsenic compounds, Wisconsin, Groundwater resources, Disposal, Waste disposal, Wells, Potable water, Clays, Waste storage.

During the 1950's and 1960's, a total of 27,000 pounds of arsenic as sodium arsenite was applied to Little Muskego Lake in Wisconsin to control aquatic macrophytes that interfered with recreational usage. The proposed project would remove about 2.25 million cubic yards of sediment---7,000 pounds of the applied arsenic---by hydraulic dredging, and deposit it in a disposal site near a large number of private water supply wells. The study suggests that arsenic contamination of groundwater is unlikely and even under worst case anaerobic conditions, soluble arsenic concentrations would still be expected to meet drinking water standards. Sediment arsenic is strongly adsorbed by sediment solids and by native soils from the disposal sites. The dissolved arsenic concentrations would not exceed 50 micrograms/L within the sites, and would decrease in concentration to 5 micrograms/L after passing through only a few centimeters of native soil. To provide an additional safety factor, a minimum of eighteen inches of clayey bottom soil, along with groundwater quality monitoring, is proposed at the disposal sites. (Garrison-Omniplan)
W81-00966

5F. Water Treatment and Quality Alteration

EVALUATION OF PROCEDURES FOR RECOVERY OF VIRUSES FROM WATER. I. CONCENTRATION SYSTEMS,
Severn Trent Water Authority, Coventry (England). Regional Lab.
R. Morris, and W. M. Waite.
Water Research, Vol 14, No 7, p 791-793, July, 1980. 3 Tab, 11 Ref.

Descriptors: *Viruses, *Filters, *Adsorption, Potable water, Rivers, Biological membranes, Separation techniques, Water purification, Analytical techniques, Aluminum, Cation adsorption, Cations, Monitoring, Aquatic ecosystems.

Two fiberglass filters and one cellulosic filter were evaluated for the recovery of poliovirus type 2 seeded into tap and river waters. The organic flocculation technique was used as a standard secondary concentration procedure with the aim of establishing a reliable method for the routine virological monitoring of aquatic ecosystems. The role of aluminum cations in viral recovery was also investigated. The best recoveries were obtained with fiberglass filters used in conjunction with 0.005 M AlCl3 x 6H20. A four-fold greater efficiency was achieved in fiberglass filters with added aluminum cations than without the aluminum cations. No such effect from the addition of aluminum cations was observed in the viral recovery efficiency of the cellulose nitrate membrane filters. The efficiency of organic flocculation as a secondary concentration step varied with viral serotypes used. The methods investigated were considered suitable for recovery of enteroviruses from tap and river water. (See also W81-00767) (Geiger-FRC)
W81-00766

MODE OF BACTERIAL INACTIVATION BY CHLORINE DIOXIDE,
John Hopkins Univ., Baltimore, MD. Div. of Environmental Health Engineering.
S. D. Roller, V. P. Olivieri, and K. Kawata.
Water Research, Vol 14, No 6, p 635-641, June, 1980. 6 Fig, 17 Ref.

Descriptors: *Bacteria, *Disinfection, *Chlorine dioxide, *Mode of action, E. coli, Chlorination, Viability, Proteins, Pollutants, Water treatment, Potable water, Chlorine, Enzymes.

The effects of chlorine dioxide, an alternative for chlorine as a water disinfectant, on the dehydrogenase enzymes, protein synthesis, and deoxyribonucleic acid (DNA) of bacteria were examined. Tests were conducted in a unit which allowed sampling for bacterial survivals from 5 to 1800 seconds after chlorine dioxide addition. The pour plate method was used to assess bacterial numbers, and total dehydrogenase activity of E. coli was measured colorimetrically. Cell extracts were evaluated for their ability to incorporate radioactive phenylalanine into protein, and DNA from Haemophilus influenzae treated with chlorine dioxide was tested for its ability to transform competent cells. The transformability of partially purified DNA exposed to chlorine dioxide was also determined. Results showed a complete inhibition of total dehydrogenase activity within the first 5 seconds of exposure. Protein synthesis was inhibited by chlorine dioxide in a dose-dependent manner. Treatment with glutathione did not reverse the effects of the disinfectant on total dehydrogenase activity, protein synthesis, or bacterial viability. Chlorine dioxide had no observable effect on the DNA transforming ability of whole cells or partially purified DNA extracts of H. influenzae. It was concluded that neither dehydrogenases, DNA, nor proteins are the major site of action of chlorine dioxide on bacterial cells, although inhibition of protein synthesis may play a part in cell mortality. (Geiger-FRC)
W81-00864

KINETICS OF SORPTION AND DESORPTION OF HCL AND LOW MOLECULAR WEIGHT ORGANIC ACIDS BY STYRENE AND ACRYLIC WEAK BASE RESINS,
Chemical Technology Inst., Prague Czechoslovakia). Dept. of Power Engineering.
Z. Matejka, and J. Eliasek.
Water Research, Vol 14, No 5, p 467-470, May, 1980. 4 Tab, 5 Ref.

Descriptors: *Acids, *Sorption, *Ion exchange, Resins, Plastics, Kinetics, Inorganic acids, Organic acids, Separation techniques, Gels, Diffusion.

The diffusion rates of HCl and low-molecular weight organic acids such as caproic acid and sulfosalicyclic acid were compared on polystyrene and acrylic weak base resins for sorption and desorption. The kinetics for comparison of the individual resins were calculated on the basis of a reaction half-time. The effects of macroporous or gelular matrix on the kinetic properties for styrene and acrylic resins were determined and compared. Acrylic resins were preferable for sorption and desorption of HCl at low concentrations. The macroporous-styrene resins were better at higher concentrations. At all concentrations the sorption of low-molecular organic acids was primarily controlled by selectivity and proceeded faster on acrylic resins. The concentration of the elution solution governed desorption. Desorption occurred faster on macroporous styrene resins. The macroporous matrix in general had a substantially smaller kinetic advantage for acrylic than for styrene weak base resins. (Baker-FRC)
W81-00867

THE PRODUCTION OF BROMOPHENOLS RESULTING FROM THE CHLORINATION OF WATERS CONTAINING BROMIDE ION AND PHENOL,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
J. A. Sweetman, and M. S. Simmons.
Water Research, Vol 14, No 3, p 287-290, March,

1980. 1 Fig, 3 Tab, 26 Ref.

Descriptors: *Chlorination, *Phenols, *Water treatment, *Bromide, Water pollution sources, Chemistry, Halogens, Aromatic compounds, Ammonia, Laboratory tests.

Chlorine-induced bromination using phenol as a model compound was investigated as part of a study of possible formation of brominated phenols during the chlorination of natural waters. The water sample to be chlorinated contained both phenol and bromide ion at a pH of 7.4. Direct bromination with HOBr was tested at four ratios of HOBr:phenol. In all cases the main product was 2,6,6-tribromophenol. Chlorine-induced bromination with equimolar amounts of hypochlorous acid and KBr added produced 2,4,6-tribromophenol. The findings suggest that chlorination, bromination and mixed halogenation products should be expected when water that contains bromide ion undergoes chlorination. The presence of ammonia in the water can affect the outcome. (Baker-FRC)
W81-00871

COLOUR AND TURBIDITY REMOVAL WITH REUSABLE MAGNETIC PARTICLES-I. USE OF MAGNETIC CATION EXCHANGE RESINS TO INTRODUCE ALUMINIUM IONS,
Commonwealth Scientific and Industrial Research Organization, South Melbourne (Australia). Div. of Chemical Engineering.
N. J. Anderson, R. J. Eldridge, L. O. Kolarik, E. A. Swinton, and D. E. Weiss.
Water Research, Vol 14, No 8, p 959-966, August, 1980. 2 Fig, 4 Tab, 10 Ref.

Descriptors: *Flocculation, *Turbidity, *Surface waters, *Aluminum, *Cation exchange, Suspended solids, Separation techniques, Sludge, Hardness, Color, Iron oxides, Water purification, Water treatment, Adsorption, Magnetism.

The recovery of suspended solids from surface waters by magnetic action exchange resins was studied in laboratory test. An amberlite CG50 resin and a magnetic PVA acrylic acid graft resin were examined for Al and Fe cation adsorption. Results showed that 70-80% loadings of Al and 15-30% loadings of Fe could be achieved under the range of pH values tested. Other experiments using resins of various particle sizes were conducted, with and without the incorporation of magnetic iron oxide into the resins. When the resin beads were small they acted as nuclei for floc settling, and flocculation was accelerated. When magnetic iron oxide was incorporated into the resin beads, they were easily separable from the clarified water. Partial reloading of the resin with Al cations was carried out by acidification of the resin-containing sludge. Hydrolysis of Al ions within the resin made the regenerated sludge ineffective as a coagulant. (Geiger-FRC)
W81-00882

AN EPIDEMIOLOGIC STUDY OF THE RELATIONSHIP BETWEEN HEPATITIS A AND WATER SUPPLY CHARACTERISTICS AND TREATMENT,
Health Research Lab., Cincinnati, OH.
O. Batik, G. F. Craun, R. W. Tuthill, and D. F. Kraemer.
American Journal of Public Health, Vol 70, No 2, p 167-168, February, 1980. 9 Ref.

Descriptors: *Viruses, *Disinfection, *Human diseases, *Epidemiology, *Potable water, Chlorination, Water treatment, Public health, Water pollution, Morbidity, Water pollution sources, Water supply, Statistics.

Outbreaks of hepatitis A (HA) have been associated with drinking water contamination. An ecological cross-sectional study was conducted to determine whether water source or water treatment processes impact upon endemic rates of HA. Only counties of the state studied which had distinct water treatment and distribution systems were included in the investigation. State Health Department records of HA morbidity data from 1965 to 1977 were utilized, and demographic variables were examined to control for factors which might influence HA morbidity rates. Results showed that none of the water supply source or treatment variables was significantly correlated with HA age-adjusted morbidity ratios. A statistically significant relationship was noted between mean annual HA rates and the median age of the county population. It was suggested that the hypothesized relationship between water treatment processes and HA might not have been detectable on the county data level and therefore, weak relationships between the two on an individual basis should not be ruled out. (Geiger-FRC)
W81-00897

PRECHLORINATION TREATMENT OF WATER TO REDUCE CHLOROFORM LEVELS,
Kansas Univ., Lawrence. Dept. of Chemistry.
K. Voss, T. Votapka, and C. Bricker.
Water Research, Vol 14, No 7, p 921-926, July, 1980. 5 Fig, 1 Tab, 15 Ref.

Descriptors: *Water treatment, *Trihalomethanes, *Chloroform, *Water quality, *Humic acids, Public health, Potable water, Decomposing organic matter, Chlorination, Gas chromatography.

In an effort to remove the precursors of trihalomethanes (THM), solutions of humic acid as well as Kansas River water were treated with potassium permanganate ($KMnO_4$), potassium ferrate (K_2FeO_4) or hydrogen peroxide (H_2O_2) prior to chlorination. Ferrate pretreatment had no effect in reducing the amount of chloroform produced when water containing humic acid was chlorinated. Pretreatment of humic acid solutions with $KMnO_4$ at an initial pH of 10.3 prior to chlorination significantly reduced the formation of chloroform. A 5 ppm solution of humic acid treated with H_2O_2 at a pH of 10.3 for 68 hr and then with hypochlorite for 16 hr had no detectable chloroform present. Kansas River water treated with H_2O_2 and hypochlorite also had chloroform levels below detectable limits. All solution preparation and analytical conditions and methodologies are described in detail. (McKeon-FRC)
W81-00921

CALCIUM CARBONATE HEXAHYDRATE: ITS PROPERTIES AND FORMATION IN LIME-SODA SOFTENING,
Essex Water Co., Maldon (England).
J. G. Slack.
Water Research, Vol 14, No 7, p 799-804, July, 1980. 3 Fig, 4 Tab, 6 Ref.

Descriptors: *Water softening, *Lime, *Calcium carbonate, *Hydrates, Hardness, Water treatment, Precipitation, Calcium compounds, Chemical properties, Separation techniques, Rivers, Crystallization, Hydration, Calcite, Sodium compounds

The occurrence of supersaturation during lime/soda water softening is usually associated with the formation of a metastable hexahydrate of calcium carbonate that crystallizes when conditions are unfavorable for production of the usual calcite product. This hexahydrate has been reported to occur at several water treatment works for Essex River waters. Formation of the hydrated salt was favored by high orthophosphate levels and low water temperatures. The pure well-defined crystals formed by calcium carbonate hexahydrate were much more soluble in water than calcite crystals. When the hydrated product crystallized, the efficiency of the lime/soda water softening process was considerably reduced, requiring increased chemicals for softening and subsequent stabilization of softened water. Hexahydrate formation has been considerably reduced by phosphate precipitation by ferric salts before softening and by seeding with pre-fabricated calcite nuclei to induce calcite crystal formation. (Geiger-FRC)
W81-00923

APPLICATION OF WATER EXTRACT OF BROWN COAL FLY ASH TO PHOSPHATE PRECIPITATION FROM POLLUTED WATERS,
Polish Academy of Sciences, Gdansk. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 5D.
W81-00928

LAKE RESTORATION BY DILUTION: MOSES LAKE, WASHINGTON,
Washington Univ., Seattle. Dept. of Civil Engineering.
E. B. Welch, and C. R. Patmont.
Water Research, Vol 14, No 9, p 1317-1325, September, 1980. 5 Fig, 4 Tab, 11 Ref.

Descriptors: *Lakes, *Algae, *Eutrophication, Cyanophyta, Nuisance algae, *Water quality control, Nutrients, Nutrient removal, Water quality, Chlorophyll, Phosphorus, Reclamation, Water pollution control, Washington.

Low nutrient water from the Columbia River was added to Moses Lake at Parker Horn on three occasions in 1977 and once in 1978, during the spring-summer period. Chlorophyll a decreased to a May-September mean of about 15 microg/liter in 1978, which was a reduction of almost 80% in Parker Horn compared with 1969-70 values, and over 60% elsewhere in the lake. Total phosphorus (P) declined as much as 50-60% below the 1969-1970 values, but still remained rather high (70-90 microg/liter). Following dilution, blue-green algae comprised much less of the plankton crop (96% in 1970 compared with 68% in 1977-78). On an annual basis the dilution water did not show such a marked impact on P inflow concentration, reducing it from about 130-140 microg/liter to 100 microg/liter. Thus, the striking improvement in blue-green algal levels was apparently caused by factors other than a limitation on the pool of total P, and may be related to dilution of blue-green excretory products. A dilution water input of about 6 cu m/s continuously during April-September should provide adequate control of eutrophication in at least 30% of the lake volume proximal to the input and Parker Horn. That would provide an exchange rate of 5%/day for Parker Horn and should achieve lake water residuals of $<$ or $=$ 50% by midsummer. Two additional inputs to the lake are proposed for Phases II and III of the restoration project. (McKeon-FRC)
W81-00955

THE EFFECTIVENESS OF CHLORINE RESIDUALS IN INACTIVATION OF BACTERIA AND VIRUSES INTRODUCED BY POST-TREATMENT CONTAMINATION,
Johns Hopkins Univ., Baltimore, MD. School of Hygiene and Public Health
M. C. Snead, V. P. Olivieri, K. Kawata, and C. W. Kruse
Water Research, Vol 14, No 5, p 403-408, May, 1980. 4 Fig, 2 Tab, 11 Ref.

Descriptors: *Chlorination, *Viruses, *Bacteria, *Distribution systems, *Water pollution, Disinfection, Shigella, Salmonella, Coliforms, Hydrogen ion concentration, Temperature, Potable water, Sewage, Sewage treatment, Laboratory tests, Simulation analysis, Resistance, Public health, Water quality, Water pollution sources.

The effectiveness of a chlorine residual in water distribution systems in protecting against bacterial and viral contamination was investigated in a simulated situation of cross connection contamination by autoclaved raw sewage spiked with 2 viruses and 3 bacteria. Tap water was adjusted to the proper pH, temperature and residual chlorine level, then challenged with varying levels of the autoclaved sewage seeded with Salmonella typhimurium, Shigella sonnei, a coliform (IMVIC $++--$), poliovirus 1 and bacterial virus f2. Survival of the sewage contaminants was determined over a 2 hour period. Microbial inactivation increased with decreasing pH and sewage levels and increasing temperatures and chlorine levels. A greater inactivation of microbes occurred with an initial free chlorine residual than was found with an equivalent initial combined chlorine residual. The most resistant species was bacterial virus f2, followed by poliovirus 1 and the three bacterial organisms. A bacterial inactivation of 3 logs or greater and a

viral inactivation of less than 2 logs was achieved after 1 hour with addded sewage levels up to 1% by volume at pH 8 and an initial free chlorine residual of 0.7 mg/liter. (Geiger-FRC)
W81-00960

5G. Water Quality Control

INTERACTION OF BACTERIOPHAGE R17 AND REOVIRUS TYPE III WITH THE CLAY MINERAL ALLOPHANE,
Waikato Univ., Hamilton (New Zealand). Dept. of Chemistry.
D. H. Taylor, A. R. Bellamy, and A. T. Wilson.
Water Research, Vol 14, No 4, p 339-346, April, 1980. 6 Fig, 1 Tab, 30 Ref.

Descriptors: *Adsorption, *Clay minerals, *Viruses, *Water purification, Montmorillonite, Infection, Hydrogen ion concentration, Kinetics, Bacteriophage, Suspended solids, Kaolinite, Illite, Suspensions, Natural streams, Phosphates, Sodium chloride, Salts, Freshwater, Radioactivity, Physical properties.

Clay minerals have been shown to be effective adsorbents of viruses due to the high surface area provided by their fine particle size. The use of clay minerals as a means of reducing virus particles in water purification seems attractive due to the readily available supply of these substances at low costs. The effectiveness of the amorphous aluminosilicate clay mineral allophane as an adsorbent for R17 bacteriophage and reovirus type III was examined. The principal factors affecting adsorption were found to be mixing time, pH, and the concentrations and isoelectric points of both the allophane and the viruses. Allophane exhibited good adsorption of both reovirus type III and the R17 bacteriophage in the pH range of 5 to 7, corresponding to the pH range of many natural freshwater systems. Experiments using highly purified radioactively labeled reovirus were conducted to investigate the kinetics of virus adsorption to allophane. Virus desorption was studied in solutions of sodium chloride, sodium phosphate, and sodium hexametaphosphate. These studies made it possible to follow the distribution of the virus in a clay suspension and observe its specific infectivity. When adsorbed virus was eluted by neutral phosphate solutions it retained its physical integrity but had a lower specific infectivity. (Geiger-FRC)
W81-00781

CATCHMENT QUALITY CONTROL,
Thames Water Authority, London (England). Directorate of Scientific Services.
L. B. Wood, and M. L. Richardson.
Progress in Water Technology, Vol 12, No 3, p 1-12, 1980. 2 Fig, 10 Tab, 9 Ref.

Descriptors: *Quality control, *Potable water, *Methodology, *Chemicals, *Rivers, Water quality, Reclaimed water, Industrial wastes, Surfactants, Runoff, Water pollution sources, Detergents, Europe, Thames River, Lee River, London, United Kingdom.

A procedure was established for assessing the nature and concentrations of micropollutants from all sources in river water used for potable supply. This report deals with micropollutants from the following sources; industrial discharges, agricultural and highway run-off, and domestic wastes. Domestic wastes include pharmaceutical products, detergents, cosmetics, toiletries, and disinfectants. Studies were made of the quality of the water in the Lee River and Thames River near London. Results are given for: micropollutants in the Lee River derived from industrial sources, micropollutants in the non-tidal Thames and Lee Rivers, and concentration of non-ionic surfactants in the Thames and Lee Rivers. Despite the wide range of sources of chemicals that could enter the water cycle, no particular hazard was found. (Small-FRC)
W81-00854

BLUE-GREEN ALGAE IN LAKE MJOSA AND OTHER NORWEGIAN LAKES,
Norsk Inst. for Vannforskning, Oslo.
For primary bibliographic entry see Field 5C.
W81-00859

THE CASE OF LAKE MJOSA,
Norsk Inst. for Vannforskning, Oslo.
For primary bibliographic entry see Field 5C.
W81-00860

APPLICATION OF US OECD EUTROPHICATION STUDY RESULTS TO DEEP LAKES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W81-00862

WELL WATER QUALITY ON MOEN ISLAND, TRUK,
Guam Univ., Agana. Water Resources Research Center.
R. N. Clayshulte, and W. J. Zolan.
Technical Report No 13, September, 1980. 36 p, 12 Fig, 11 Tab, 12 Ref, 1 Append.

Descriptors: *Guam, *Wells, *Groundwater, *Water pollution sources, Chemical analysis, *Water quality, Chlorination, Anaerobic bacteria, Nitrogen compounds, Disinfection, Potable water, Water temperature, Subsurface investigations, Physical properties.

A study was begun in May 1979 to determine the water quality of production wells connected to the distribution system of Moen Island. Six wells were monitored on a monthly basis for one year. Basic physical, chemical and bacteriological parameters were measured from water samples collected at each well head after a minimum one minute flushing period. Average well water pH ranged from 6.21 to 6.54. Levels of free carbon dioxide were generally high; however, dissolved nitrogen and phosphorus concentrations were low. Dissolved nutrients do not effect the structural components of the wells. Mean temperatures were consistent between the wells and were not considered abnormally high. Alakalinity values were always in the form of bicarbonate alkalinity, and showed decreases from January to May 1980. Chlorine levels were low except for one well. The mean turbidity levels of 4 wells were in violation of the territorial safe drinking water standard. Sulfate and reactive silicate concentrations were low in all of the well waters. Contamination is the major problem associated with production wells, including frequent total coliform bacteria and high turbidity levels. These imply groundwater contamination. Recommendations to improve well water quality include: disinfection procedures, monitoring programs, and methods to determine sources of contamination. (Vernale-Omniplan)
W81-00866

EVALUATING THE TOXICITY OF EFFLUENTS,
Los Angeles Bureau of Sanitation, CA.
For primary bibliographic entry see Field 6E.
W81-00915

WHOLE LAKE RESPONSES TO LOW LEVEL COPPER SULFATE TREATMENT,
Syracuse Univ., NY. Dept. of Civil Engineering.
S. W. Effler, S. Litten, S. D. Field, T. Tong-Ngork, and F. Hale.
Water Research, Vol 14, No 10, p 1489-1499, October, 1980. 12 Fig, 2 Tab, 49 Ref.

Descriptors: *Copper sulfate, *Aquatic life, *Monitoring, *Environmental effects, *Algicides, *Sampling, Aquatic bacteria, Nutrients, Phosphorus, Aquatic algae, Lakes, Pesticides, Zooplankton, Aquatic populations, Cazenovia Lake(NY).

A time intensive monitoring program was used to evaluate the toxicity of three low level copper sulfate applications (455 kg CuSO4x5H2O in a 10% solution) to Cazenovia Lake, New York. Filtered and total copper, type and number of phytoplankton, in situ assimilation of radioactively labeled carbon, bacterial numbers, enumeration and identification of zooplankton, the status of macrophyte nutrients, and filtered and reactive total phosphorus were assessed. Copper sulfate treatment caused only a slight increase in filtered copper levels, with maxima of 5 micrograms/liter over a 2-5 day period. No algicidal action resulted from the low level applications; however, short term stress and changes in the natural seasonal succession within these populations were observed. No significant effects upon the zooplankton, submerged macrophytes, or amounts of phosphorus in the water column were found due to the low level treatments. After each copper sulfate application, sharp decreases were noted in the water column bacteria, showing the direct negative impact of the treatment. After several days, recoveries in bacterial populations were observed. Phytoplankton populations reached normal levels within 1 week after copper sulfate treatment. (Geiger-FRC)
W81-00947

AERATION AS A TOOL TO IMPROVE WATER QUALITY AND REDUCE THE GROWTH OF HYDRILLA,
University of South Florida, Tampa.
For primary bibliographic entry see Field 4A.
W81-00961

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

A SYSTEMS APPROACH TO SOLVING RESOURCE ALLOCATION PROBLEMS WITH MULTIPLE OBJECTIVES,
California Univ., Los Angeles. Dept. of Engineering Systems.
For primary bibliographic entry see Field 4A.
W81-00751

EXPANDED FLOOD PLAIN INFORMATION STUDY WILLOW, ALASKA.
Corps of Engineers, Anchorage, AK. Alaska District.
For primary bibliographic entry see Field 4A.
W81-00757

ESSENTIALS OF GROUND-WATER HYDROLOGY PERTINENT TO WATER-RESOURCES PLANNING,
Water Resources Council, Washington, D. C. Hydrology Committee.
For primary bibliographic entry see Field 2F.
W81-00759

GREEN RIVER BASIN OPTIMIZATION - SIMULATION MODEL,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
H. Yazicigil, G. H. Toebes, and M. H. Houck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-143356, Price codes: A10 in paper copy, A01 in microfiche. Technical Report No 137, November, 1980. 190 p, 74 Fig, 32 Tab, 26 Ref, 2 Append. OWRT B-094-IND(5).

Descriptors: *Model studies, *Optimization, *Reservoir operations, *Flood control, *Recreation, *Low flow augmentation, River forecasting, Reservoir management, Reservoir releases, Reservoir storage, Synthetic hydrology, Flow augmentation, Reservoir yield, Kentucky, *Green River basin(KY).

The report presents an optimal operation of an existing multi-purpose multireservoir system using forecasts. An optimization - simulation model is constructed for a system of four flood control reservoirs in the Green River Basin, Kentucky, having recreation and low-flow augmentation as secondary objectives. The resulting model, called GRB0PM2, is designed for use in real-time as well as in long-run operation studies. The descriptive

components of the model consists of a segmented model comprising nine multi-input linear (MIL) models of the river system downstream of the four reservoirs; whereas the prescriptive component is largely in the form of an operating policy algorithm that involves repeated solution of a mathematical problem. The optimization technique employed to solve the mathematical program is Linear Programming. The use of the GRBOPM2 model in long-run reservoirs operations studies is demonstrated. The systems responses under various operating and hydrologic conditions have been obtained. In particular trade-off curves between various systems' objectives were generated both for winter and summer sessions by using historical hydrologic as well as synthetic model input data.
W81-00806

SCALING IMPACTS OF ALTERNATIVE PLANS,
Colorado Univ. at Boulder. Center for Research on Judgement and Policy.
For primary bibliographic entry see Field 6B.
W81-00838

PUMPED STORAGE SITE SELECTION PROCESS AS DEVELOPED BY THE SALT RIVER PROJECT, PHOENIX, ARIZONA,
Salt River Project, Phoenix, AZ.
G. D. Harris.
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J.P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 190-206. 7 Fig, 68 Ref.

Descriptors: *Pumped storage, *Reservoir sites, *Hydroelectric plants, *Decision making, Reservoirs, Planning, Arizona, Evaluation, Cost analysis, Topography, *Phoenix(AZ).

Current projections of the demand for electrical power in Arizona indicate that the portion of the Phoenix Metropolitan area served by the Salt River Project will have sufficient generation capacity to provide for the base load for the foreseeable future, but that peak period demand will exceed the generation capacity in the early 1990s. A study was undertaken to select the best site in Arizona for a new hydroelectric pumped storage facility. A total of 138 sites were identified, based on topography. A series of three screening processes was applied to the sites. Screening was guided by two primary premises: all screens were to be positively pass or fail, and the screens were to be in a sequence that allowed dropping a number of sites based on existing information before screens requiring additonal research were applied. The screening procedure left a total of 16 sites. Further evaluation left six sites for which cost estimates were developed. One site, Alchesay Canyon, was selected for further study, with four backup sites. (Moore-SRC)
W81-00853

URBAN WATER SUPPLY PLANNING,
Southern Illinois Univ., Carbondale.
D. D. Baumann, and J. J. Boland.
Water Spectrum, Vol 12, No 4, p 33-41, Fall, 1980. 1 Fig, 1 Tab.

Descriptors: *Planning, *Water management, *Water resource development, *Water utilization, Urban hydrology, Efficiencies, Costs, Water resources, Water quality, Water supply, Water requirements.

Present urban water supply planning has become a challenging and complex task. Today's problems in planning reflect not only an inadequate supply, but a wide range of factors involving projection and management. Water conservation, i.e., a beneficial reduction in water use or water loss, is increasingly important. All water conservation practices are components of efficient management of water resources. The water resource planner must consider the efficient allocation of water resources at every stage of distribution and use. Many problems are associated with measuring the effectiveness of potential water conservation techniques. Urban water supply planning is influenced by environmental restrictions, laws and regulations, water quality criteria, increased energy costs, and water resource development expenses and water demands. Various approaches available to the water resource planner are discussed, and the effectiveness of each is evaluated. (Geiger-FRC)
W81-00910

COMMUNITY PLANNING FOR WATER RESOURCES MANAGEMENT, A GUIDEBOOK.
Skidmore, Owings, and Merrill, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-144867, Price codes: A03 in paper copy, A01 in microfiche. Publication prepared for Office of Water Research and Technology, September, 1979. 24 p, 6 Fig. OWRT-C-80104-P(No 8402)(2).

Descriptors: *Water resources development, *Planning, *Community development, *Water utilization, *Water resources planning, Resources, City planning, Economics, Urbanization, Rural areas, Alternate planning, Evaluation, Cities, Legislation, Legal aspects, Institutions, Institutional constraints, Alternative water use, Comprehensive planning, Governments, Water resources, Administration, Management.

This guidebook provides a step-by-step method to help local officials and concerned citizens solve their water resources problems by developing a community water resources management plan. Five specific steps are outlined in the planning process (with participation in planning factored into each of these steps): (1) definition of problems and goals; (2) collection and study of available data; (3) generation of a set of alternatives; (4) evaluation of the possible effects of each alternative; and (5) selection of a course of action leading from point of decision to implementation. Selection of the official or agency for a given town or city that is best prepared or most appropriate to initiating action was recommended. Numerous examples are provided for the detailed five-step process. The procedures described are designed to assist individuals in the creation of a water resources management plan to suit their community. The steps may be modified or reiterated in order to effect optimum results. The guidebook is written in a personal guidance narrative form. (Zielinski-IPA)
W81-00970

EFFECTS OF ALTERED FRESHWATER INFLOW ON ESTUARINE SYSTEMS,
Texas Univ. at Austin. Environmental Health Engineering Lab.
For primary bibliographic entry see Field 2L.
W81-00992

6B. Evaluation Process

SCALING IMPACTS OF ALTERNATIVE PLANS,
Colorado Univ. at Boulder. Center for Research on Judgement and Policy.
C. A. Brown, R. J. Quinn, and K. R. Hammond.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-128886, Price codes: A06 in paper copy, A01 in microfiche. Water and Power Resources Service Report, June 1980. 109 p, 24 Fig, 6 Ref, 7 Append. 8-02407.

Descriptors: *Water resources development, *Alternative planning, Environmental effects, Social impact, Reliability, Measurement, Evaluation, Value, Planning, Validity.

The report describes procedures for improving measurement of the effects of alternative water development plans - particularly environmental and social impacts. Basic issues in measurement are related to the task of comparing alternative plans. Four types of measurement scales are evaluated in terms of their usefulness in the planning process. The concepts of reliability and validity are discussed in detail as is the concept of a measurement standard. Measurements required for water resources planning are divided into four types: Type I - Objective application of a measurement standard; Type II - Subjective application of a measurement standard; Type III - Subjective application of general scientific principles; Type IV - Subjective application of personal values. Procedures are presented for improving measurement types II, III, and IV, focusing on: (1) Disaggregating multidimensional factors (e.g., social well-being) (2) Defining factors and subfactors; (3) Specifying relations between factors and subfactors; (4) Integrating subfactor impacts; and (5) Defining higher order factors. (Author's abstract)
W81-00838

A STUDY OF THE IMPACT OF THE HUGO RESERVOIR ON CHOCTAW AND PUSHMATAHA COUNTIES: A VIEW FOUR YEARS AFTER COMPLETION.
Evans (R. E.) and Associates, Norman, OK.
Army Engineer Institute for Water Resources Research Report 80-R1, April 1980. 241 p, 13 Fig, 53 Tab, 38 Ref, 5 Append.

Descriptors: *Economic impact, *Reservoirs, *Social impact, *Post-impoundment, *Oklahoma, Economic prediction, Reservoir construction, Employment, Recreation, Agriculture, Human population, Construction, Powerplants, Land use, Forecasting, *Hugo Reservoir(OK).

In 1967 the Corps of Engineers commissioned a pro-forma study of the impact of the Hugo Reservoir on two Southeastern Oklahoma counties, Choctaw and Pushmataha. More than ten years have passed since the first study and the construction of the reservoir were begun and more than four years have elapsed since water impoundment in the reservoir began. The actual effects of the reservoir on the study area is compared with the effects forecast by the earlier study, and new forecasts are based on the effects already experienced. The impacts measured in this study were for the short-term period, 1967-1977, and the forecasts extend to 2050 in most cases. The population of the area increased by nearly 3,000 persons between 1967 and 1977. The labor force, per capita income, farm output, value added by manufacture and bank deposits have all increased during the same period. Total construction activity in the area by 1977 exceeded the level of 1967 by $11 million, and a rapid increase in construction is projected for the period between 1980 and 2000 due to the construction of a new coal fired generating plant. The creation of the Hugo reservoir resulted in the emergence of the recreation industry as a major econmic activity in the area. The use of land changed little between 1967 and 1978, although residential uses near the lake increased by 24 acres. (Moore-SRC)
W81-00881

RIVER RECREATION USE AND ANALYSIS OF CARRYING CAPACITY,
Vermont Univ., Burlington.
R. E. Manning.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-145088, Price codes: A05 in paper copy, A01 in microfiche. Vermont Water Resources Research Center, University of Vermont, Technical Completion Report, October, 1980. 83 p, 13 Fig, 23 Tab, 68 Ref, 4 Append, OWRT-A-034-VT(1), 14-34-0001-9048.

Descriptors: *Recreation demand, *Vermont, *Rivers, *Social aspects, Water types, Recreation, Fishing, Boating, Swimming, Evaluation, Synoptic analysis, Recreation facilities, Social carrying capacity, River types, River management, User satisfaction.

The major objectives of this study were to describe the nature and intensity of river recreation activity in Vermont and to develop methods for determining the social carrying capacity of rivers for recreation. The principal research method was a field survey of recreationists on four major Vermont rivers during the spring and summer of 1978. Substantial dissatisfaction was found among river users

with regard to selected river use problems and conflicts. Several systematic relationships were found between recreation activity patterns and river type as defined by physical/biological characteristics and cultural setting. Each of six river types examined demonstrated distinctive patterns of recreation behavior with regard to type and intensity of recreation activities, desired use densities, and problems and conflicts experienced by recreationists. These relationships provide an important initial base upon which to structure comprehensive river recreation planning and management. This study recommends special efforts to protect and preserve the recreation values of Vermont's rivers and streams.
W81-00972

OPTIMAL REGIONAL CONJUNCTIVE WATER MANAGEMENT,
Auslam and Associates, Sacramento, CA.
J. E. Noel, B. D. Gardner, and C. V. Moore.
American Journal of Agricultural Economics, Vol 62, No 3, p 489-498, August, 1980. 1 Fig, 7 Tab, 26 Ref. OWRT-B-187-CAL(6).

Descriptors: *Model studies, *Water allocation(Applied), *Cost analysis, *Water costs, *Water management(Applied), Pumping, Water utilization, Taxes, Management, Mathematics, Estimating, Analytical techniques, Simulation, Research and development, Testing, Water rates, Water sources, Water supply, Agriculture, Cities, Groundwater management, Groundwater, Surface waters, Economics.

An optimal control model was briefly described for determining the optimal spatial and temporal allocation of groundwater and surface water among agricultural and urban uses. The control model was then applied to a representative California region (Yolo County) under several sets of energy costs. Two policies (pro-rata allocation and taxation) were evaluated empirically as alternatives for accounting for externalities due to the common pool problem. The advantages of the control model over other dynamic models were enumerated. Optimal rates of groundwater pumpage over the planning horizon were highly sensitive to increasing energy costs. Groundwater basins are shown to react differently to alternative economic and hydrological parameters. In a dynamic setting, a policy of pump taxes was shown empirically to be superior to pro-rata quotas and uncontrolled pumpage. The two broad policy implications drawn from the results were that the areal size of a water resource-planning unit must be carefully chosen, and that certain economic impacts associate with policy alternatives for moving current groundwater allocations to a more socially preferred set. (Zielinski-IPA)
W81-00988

ESTIMATING ECONOMIC DEVELOPMENT IMPACTS; AN ALTERNATIVE APPROACH,
Washington Univ., St. Louis. Inst. for Urban and Regional Studies.
E. Greenberg, C. L. Leven, J. T. Little, and R. P. Parks.
Institute for Water Resources Contract Report 80-C3, August, 1980. 39 p, 1 Append.

Descriptors: *Economic impact, *Water resources development, *Mathematical models, Leontief models, Model studies, Economics, Investment, Project benefits, Regional economics, Employment.

Federally financed investments have a variety of impacts on the immediate region in which they are located. An alternate approach to estimating economic development benefits is outlined for water resources projects. A critique of the typical approach to estimating economic developmental impacts indicates that traditional Leontief-type calculations are valid under certain circumstances. A more general model of economic impact uses labor as one factor and land, waterways, or recreational sites as another. In the two-factor, two-good model, the two goods represent a range of goods in the real world, one good labor intensive and the other intensive in the use of the factor which the project affects. The effects of the project are changes in technology, factor prices, or factor endowments. The impact is measured as the percentage change in Gross Regional Product due to the changes in the infrastructure. The method outlined offers a good basis for an experimental effort at estimating economic impacts of a project in an alternate way that is both more defensible theoretically and calls for less data, though of a somewhat less conventional sort. (Moore-SRC)
W81-00989

THE EVALUATION OF WATER CONSERVATION FOR MUNICIPAL AND INDUSTRIAL WATER SUPPLY: PROCEDURES MANUAL,
Planning and Management Consultants Ltd., Carbondale, IL.
D. D. Baumann, J. J. Boland, and J. H. Sims.
Army Engineer Institute for Water Resources Contract Report 80-1, April, 1980. 73 p, 5 Fig, 1 Tab, 2 Append.

Descriptors: *Water conservation, *Evaluation, *Municipal water, *Industrial water, Cost-benefit analysis, Planning, Water supply, Social aspects, Alternative planning, Economics, Water demand.

Water conservation proposals serve to reduce the gap between future demand and future water supply. Specific water conservation measures may be classified as regulatory practices, management practices or education efforts. The evaluation procedure is used to determine whether water supply plans can be improved by inclusion of a water conservation element. Water supply plans are first formulated according to existing procedures, without consideration of additional water conservation measures. The potential water conservation measures are identified by the measure-specific analysis; these individual water conservation measures then are evaluated against the alternate water supply plans. Based on this evaluation, water conservation proposals are developed, which can be integrated into water supply plans, yielding alternative water supply/conservation plans. Determining the social acceptability of conservation measures requires the measurement of social ideologies. Interviews and surveys can be used to delineate social ideologies which affect the social acceptability of conservation measures. Two sample questionnaires are provided. (Moore-SRC)
W81-01000

6E. Water Law and Institutions

CLEAN WATER ACT'S PRECEPTS TO ENDURE,
Environmental Protection Agency, Springfield, IL.
M. Mauzy.
Water and Sewage Works, Vol 127, No 10, p 38-40, October, 1980.

Descriptors: *Clean water act, *Financing, *Management, *Administration, Economics, Legislation, Permits, Water quality standards, Regulation, Monitoring, Grants, Operation.

Changes are expected during the 1980s in regard to administrative decisions affecting water quality improvement legislation. However, the magnitude of these changes is expected to be somewhat less than has been experienced in the past decade. Desires will be balanced with realistic goals. Economics will become important in the making of decisions. Attention must be given to the management of the various programs. Decentralization of program administration is recommended. Simplications are needed in the various regulations, with incentives introduced and maintained in the management levels of regulatory programs. Changes will be made in the awarding of construction grants and in the ways in which wastewater facilities are to be operated. Concern will continue in the area of toxic pollutants in the environment, and increased testing will be performed on laboratory animals to determine possible toxic effects on humans. Programs will be developed for controlling nonpoint sources of pollutants. (Baker-FRC)
W81-00798

FLORIDA WATER LAW 1980,
Florida Water Resources Research Center, Gainesville.
F. E. Maloney, S. J. Plager, R. C. Ausness, and B. D. E. Canter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-143430, Price codes: A99 in paper copy, A01 in microfiche. Publication No 50, 1980. 780 p, 6 Fig, 2,532 Ref. OWRT B-030-FLA(3), 14-34-0001-7113.

Descriptors: *Florida, *Water law, *Water resources development, Legislation, Judicial decisions, Planning, Legal aspects, Water pollution, Flood plain zoning, Riparian rights, Permits, Administration, Prior appropriation, Civil law, Regulation, Boundaries, Public rights, Navigation, Submerged lands.

This study is a comprehensive examination of the law respecting water use and management in the State of Florida. Common law water rights are analyzed in the first chapter, with particular attention given to the reasonable use rule. Chapter II describes the multitude of state and local agencies responsible for managing water resources in Florida. Chaper III surveys the various water allocation systems of the Eastern United States, emphasizing the Florida Water Resources Act of 1972. Common law and statutory restrictions on water pollution are analyzed in Chapter IV. The various legal doctrines governing the disposal of diffused surface waters are the subject of Chapter V. Finally, Chapter VI is concerned with submerged lands and water boundaries. The legal concept of navigability is explored and the significance of the ordinary high water mark and the mean high water line are examined.
W81-00802

INSTITUTIONAL CONSTRAINTS ON ALTERNATIVE WATER FOR ENERGY, A GUIDEBOOK FOR REGIONAL ASSESSMENTS.
Department of Energy Report DOE/EV/10180-01, November, 1980. 234 p, 15 Fig, 162 Ref.

Descriptors: *Groundwater, *Return flow, *Municipal wastes, *Saline water, *Water law, Constraints, *Impaired water use, *Powerplants, Groundwater mining, Irrigation systems, Sea water, Legal aspects, Political aspects, Social aspects, Sites, Thermal water, Prior appropriation, Water rights, Regulation, Regional analysis.

A guide is presented to the legal, political, and social constraints faced by energy developers in the acquistition of water from underground, irrigation return flow, municipal waste and saline sources. Water laws, environmental reporting, facility siting, and land use laws embody many of the institutional constraints relating to water acquisition. Whatever the stated rules with respect to water allocation, gaps sometimes exist between legal principles and practice. The principal legal systems for groundwater are absolute ownership, reasonable use, correlative rights and prior appropriation. In some states there are restrictions on groundwater mining, restrictions on off-site use, protection for holders of affected surface water rights and land owners, protection against unreasonable reductions in pressure or water table level, preferences for nonenergy uses, short time periods for putting water diligently to use, and uncertainties about the legal status of deep water, saline water, and geothermal water. The major constraint concerning the acquisition of municipal waste water for energy pertains to ownership. In many areas the return flow from irrigation is already covered by the water rights of downstream users. The acquisition of ocean water is not normally directly regulated; rather the intake structures, thermal discharges and siting are regulated. Social and political opposition to a project can transform what are otherwise procedural steps associated with water acquisition into major constraints and obstacles. (Moore-SRC)
W81-00892

THE MONOPOLIES GAME,
L. Freeman.
Water, No 34, p 22-23, September, 1980.

Descriptors: *Costs, *Efficiencies, *Water management, *Public rights, *Monopoly, Administrative agencies, Economic justification, Investigations, Legal aspects.

The United Kingdom's Monopolies and Mergers Commission has been investigating the efficiency of the Severn Trent Water Authority. The investigations were commissioned as a result of widespread consumer concern about charges levied by the Water Authority. The Commission will explain its terms of accounting to the water authority and publish its findings in advertisements in local newspapers for public comment. Many public pressure and consumer groups have already responded in writing to invitations for response from the Commission, and matters deemed worthy of further study are examined in public interest hearings. The Commission members are appointed by the Secretary of State and represent a wide range of job disciplines. Public interest hearings are attended only by water company representatives and Commission members, and all discussions are protected by the Official Secrets Act. Following hearings, reports are written up within 3 to 6 months containing the Commission's recommendations and conclusions. These reports become part of a larger full report which will be published by the Department of Trade. (Geiger-FRC)
W81-00909

EVALUATING THE TOXICITY OF EFFLUENTS,
Los Angeles Bureau of Sanitation, CA.
W. F. Garber.
Progress in Water Technology, Vol 12, No 3, p 57-67, 1980. 2 Fig, 2 Tab, 31 Ref.

Descriptors: *Regulation, *Toxins, *Effluents, *Standards, *Adoption of practices, Administrative decisions, Oceans, California, Toxicity, Methodology, Water pollution control, Water policy.

Major emphasis in the U.S. has been placed on setting standards and regulating toxins before scientific knowledge is established as to the toxicity of safe levels of these toxins. Limitation of the amount of toxic materials released into the environment is a major goal of a waste water treatment system. The only way to decide if known toxins should be manufactured and used, controlled by any type of treatment, or regulated by what partiticular standards, is to advance scientific knowledge of these substances. The State of California Ocean Plan, which governs the diffusion of treated wastewaters to the ocean, is described. The policies which guided its development, the methodology used to determine desired receiving water concentrations, and the resulting standards are presented and discussed. The scarcity of reliable bioassay information is emphasized. The present California standards are believed adequate to protect the environment. The federal insistence on near zero risk is believed unnecessary. (Small-FRC)
W81-00915

IMPLEMENTING PRETREATMENT REQUIREMENTS IN THE UNITED STATES: A STUDY OF FOUR PUBLIC AGENCIES TREATING DOMESTIC AND INDUSTRIAL WASTEWATER,
Lynam (Bart T.) and Associates, Chicago, IL.
B. T. Lynam, R. M. Linton, and K. Kirk.
Progress in Water Technology, Vol 12, No 3, p 13-21, 1980.

Descriptors: *Regulation, *Waste water treatment, *Municipal wastes, *Industrial wastes, *Toxins, Legislation, Governments, Sludge disposal, Cities, Pretreatment, Federal Water Pollution Control Act of 1972, Chattanooga, Tennessee, Rockford, Illinois, Oakland, California, New Bedford, Massachusetts.

The Association of Metropolitan Sewerage Agencies studied how four municipalities were confronting the U. S. Environmental Protection Agency's requirement that industrial users of municipal treatment systems meet pretreatment standards. The four systems: Chattanooga, Tennessee; Rockford, Illinois; Oakland, California; and New Bedford, Massachusetts, faced different problems because of differences in size, treatment process, industrial waste loadings, and geographic location. The experiences of water pollution professionals in these cities indicate that the federal requirements are achievable but start-up and operating costs are high. Industry will in general be hard-pressed to pay the costs of reasonable pretreatment. Deciding how much to charge each industry using the treatment facility is also a problem. Little is known about the 65 toxic pollutants which are regulated, and disposal of the highly toxic sludges in a cost-effective and environmentally sound fashion will be difficult. (Small-FRC)
W81-00916

THE RELATIONSHIP BETWEEN WATER CONSERVATION AND MINERAL DEVELOPMENT,
Alabama Univ. University. School of Law.
H. Cohen.
Alabama Law Review, Vol 31, No 3, p 547-609, Summer, 1980.

Descriptors: *Mineral industry, *Oil industry, *Water conservation, Mine wastes, *Legal aspects, *Industrial production, Evaluation, Planning, Mining, Coal mine wastes, Water pollution, Mine drainage, Water law, Legislation, Institutional constraints, Water policy, Governments, Oil wells, Natural gas, Waste disposal wells, Alabama, Pennsylvania.

This report briefly surveyed the background of the national energy problem and the common law applicable to the relationship between mineral production and water pollution, and discussed the water-related problems that might arise from an accelerated mineral production program. State law relative to mining and water pollution was discussed for Pennsylvania and Alabama, as well as in relation to the Federal Water Pollution Control Act (FWPCA). Although the underpinnings of the legal controls affecting both water conservation and mineral production were deemed sound, improvements in the present system were suggested. These suggestions included: (1) mapping and definition of all abandoned underground/surface mines and oil/gas wells to delineate specific effects on water resources; (2) Congressional ammendment of FWPCA and Surface Mining Control and Reclamation Act to define jurisdictional limits of EPA and the Office of Surface Mining Reclamation and Enforcement relative to mining pollution control activities; (3) new State legislation for municipalities supplying drinking water, to investigate/inspect activities that may endanger water supply; (4) State legislature definitions of pollution that includes those withdrawing large amounts of water that reduces water quality, as polluters; and (5) Congressional exemption of certain oil/gas disposal wells from Safe Drinking Water Act coverage not impacting freshwater aquifers. (Zielinski-IPA)
W81-00967

A HISTORY OF DRAINAGE LAW IN MINNESOTA WITH SPECIAL EMPHASIS ON THE LEGAL STATUS OF WET LANDS,
Mankato State Univ., MN. Dept. of Biological Sciences.
K. E. King.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-134900, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center, University of Minnesota, Minneapolis, Bulletin 106, November, 1980. 48 p, 28 Ref, 5 Append. OWRT-A-040-MINN(6).

Descriptors: *Drainage practices, *Wetlands, *Legal aspects, *Minnesota, *Drainage effects, Drainage, Drainage patterns, Drainage programs, Evaluation, Planning, Drainage water, Water law, Water permits, Water rights, Bodies of water, Public rights, Water distribution(Applied), Jurisdiction, Institutional constraints.

A capsulized view was presented of the laws and attitudes that have shaped the drainage history of Minnesota and have formed the basis for Minnesota's present drainage law. The presentation was divided into three temporal periods: 1858-1920 (drainage period I (DP-I)), 1920-1960 (DP-II), and 1960-1979 (DP-III). DP-I in Minnesota's history was a time of extensive drainage activity. Of the total land acreage incorporated into drainage enterprises by 1960, over 79% was affected by ditching before 1920. Acts that facilitated drainage and the legal status of State water bodies were discussed for this period. DP-II represented a time of transition in State attitudes towards drainage and water; while DP-III very likely witnessed the most dramatic statutory changes in State drainage history for water resources protection and management. Special importance was placed on the evolution of the law as pertaining to wetlands. A set of appendices provided a more detailed view of certain laws and significant legal precedents. It was concluded that, if present economic patterns persist, and landowners become dissatisfied with present laws governing public waters, more drainage is likely; and, with each wetland drained, conflicts over those remaining will escalate. (Zielinski-IPA)
W81-00969

LEGAL, FINANCIAL AND ECONOMIC ANALYSIS OF A WATER SUPPLY BANK IN IDAHO,
Idaho Univ., Moscow. Center for Business Development and Research.
C. Hofmann, J. Wegman, and F. Damanpour.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-149486. Price codes: A07 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute, University of Idaho, Technical Completion Report, August, 1980. 147 p, 3 Fig, 1 Tab, 76 Ref. OWRT-B-047-IDA(1), 14-34-0001-9112.

Descriptors: *Water allocation policy, *Legal aspects, *Economic feasibility, *Idaho, *Financial feasibility, Water supply, Pricing, Irrigation, Water districts, Water users, Water delivery, Planning, Evaluation.

Water banking can conceptually facilitate the development of rational market mechanisms for water. Idaho has authorized the establishment of a Water Supply Bank to be operated by the Idaho Water Resources Board. This study analyzes the legal, financial and economic feasibility of the Water Supply Bank. Water banking will supplement existing water transfers by water management and delivery organizations in providing access to market allocation mechanisms. While water banking can improve and facilitate the operation of market forces in water pricing and allocation, constraints on rational markets still exist. These constraints are prohibition on water transfers where adverse third-party effects are evident and institutional encumbrance which require a fixed price for the rental of storage water.
W81-00977

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT GOALS, OBJECTIVES AND PRIORITIES FOR SOUTH CAROLINA, 1982-1987,
Clemson Univ., SC. Water Resources Research Inst.
P. B. Zielinski, and J. Vorgettes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-134918, Price codes: A06 in paper copy, A01 in microfiche. Report No 91 submitted to the Office of Water Research and Technology, August, 1980. 100 p, 4 Fig, 17 Tab, 25 Ref, 1 Append.

Descriptors: *Research priorities, *South Carolina, *Planning, *Research and development, *Water quality, Water management(Applied), Water resources, Water pollution, Institutions, Optimum development plans, Desilting, Oxidation lagoons, Waste disposal, Wastes, Evaluation, Water reuse, Waste water(Pollution), Water utilization, Groundwater, Alternative planning, Project planning, Programs, Investigation, *Five-year plans.

The five-year water resources research plan for South Carolina presented background meteorological, hydrological, and geological information, a description of past/current studies, and identified water problems. Principal South Carolina water

problems were placed in three broad priority categories: those of water quality as top priority; followed by those of water resources planning and management; followed by those of water quantity. Water quality problems identified included ground/surface water pollution source identification, coastal zone groundwater pollution, waste discharges in surface waters, improved treatment performance needs for waste stabilization ponds, reduction of siltation and high nutrient levels in order to reverse lake eutrophication, and monitoring and safe disposal of toxic waste. Planning/management problems included the need for adequate groundwater data to support passage of controlling legislation; while water quantity problems included reuse and recycling of waste water effluents, and severe groundwater withdrawals in parts of the coastal plains. An estimated funding profile based on the identified priorities and covering fiscal years 1982-1986 was included. (Zielinski-IPA)
W81-00986

6G. Ecologic Impact Of Water Development

RIPARIAN HABITAT AND INSTREAM FLOW STUDIES, LOWER VERDE RIVER: FORT MCDOWELL RESERVATION, ARIZONA,
Fish and Wildlife Service, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W81-00756

EFFECT OF NUTRIENT MANIPULATION ON PLANKTON COMMUNITY STRUCTURE,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. Lang, and E. J. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-134892, Price codes: A02 in paper copy, A01 in microfiche. Completion Report 79-10, October, 1980, 10 p, 17 Ref. OWRT-A-066-ALAS(1), 14-34-001-9002.

Descriptors: Phosphorus, Carbon, *Aquatic microorganisms, *Plankton, Species composition, Alaska, *Lakes, *Ecosystems, Nutrient requirements, *Laboratory tests, *Cultures, Evaluation, Environmental effects, Macronutrient ratios.

The primary objective of this study was to use laboratory continuous cultures to evaluate the effect of changing macronutrient ratios on the microplankton species compositions of lake ecosystems. The heterotrophic yeast could outcompete the green alga for phosphate, so the alga only predominates when carbon severly limited the growth of the yeast. Most evidence indicates that heterotrophes are better competitors for mineral nutrients (like phosphorus) than are algae. Thus, in oligotrophic systems, the total biomass of the microplankton community may be limited by a mineral nutrient, but the community structure may be regulated by the type of organisms available to the heterotrophic population. The dominance of unicellular blue-greens in oligotrophic systems (since they are better competitors for phosphorus than the yeast or green alga) may be due to their ability to take up dilute phosphorus. As nutrient concentrations increase towards eutrophy, other factors such as zooplankton grazing and allelopathy may be most important in determining the structure and biomass of the microplankton community.
W81-00973

VARIATION IN INVERTEBRATE DRIFT IN SUBARCTIC ALASKAN STREAMS,
Alaska Univ., Fairbanks. Inst. of Water Resources.
J. D. LaPerriere.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-134884, Price codes: A03 in paper copy, A01 in microfiche. Completion Report 77-22-A, August, 1980. 27 p, 1 Fig, 9 Tab, 45 Ref. OWRT-A-061-ALAS(1), 14-34-001-9002.

Descriptors: *Aquatic drift, *Benthos, *Alaska, *Invertebrates, Streams, Arctic, Subarctic, *Ecosystems, Ecological distribution, Environmental effects, Algae, Phosphorus, Alkalinity, Streamflow, Velocity, Sediment-water interfaces, Forecasting, Equations.

Data from thirteen streams in interior, subarctic Alaska are analyzed to find predictive equations that explain the amount of invertebrate fish-food drifting in the water column. The alkalinity of the water and the stream's average velocity are found to be the factors that influence the amount of drift expressed as concentration or export rate. The alkalinity is shown to be related to the invertebrates' food supply. Average velocity is speculated to be an indication of the shear force at the sediment-water interface where benthic invertebrates forage for their food. These shear forces are seen to operate on benthic invertebrates in an analogous way to that in which they operate in sediment transport. The algae of boreal streams in this region are shown to be somewhat reliant on alkalinity, but a highly significant relationship is shown between total phosphorus and algae when both muskeg (brownwater) and boreal (clearwater) streams are considered together. Brownwater streams of this region tend to have a higher total phosphorus concentration than clearwater streams, but not to have a depressed pH that is characteristic of standing waters in muskeg. Recommendations are presented for further research.
W81-00974

EFFECTS OF MARSH IMPOUNDMENTS ON COASTAL FISH AND WILDLIFE RESOURCES,
Louisiana State Univ., Baton Rouge. School of Forestry and Wildlife Management.
R. H. Chabreck.
In: Proceedings of the Gulf of Mexico Coastal Ecosystems Workshop, September 4-7, 1979, Port Aransas, Texas, Fore, P. L., and Peterson, R. D., Eds., Fish and Wildlife Service, Office of Environment, Report FWS/OBS-80/30, May, 1980, p 1-16. 19 Ref.

Descriptors: *Marsh management, *Wildlife management, *Impoundments, *Coastal marshes, *Environment effects, Wetlands, Marshes, Habitat improvement, Marsh plants, Hydrology, Wildlife, Freshwater marshes, Brackish water, Water resources, Fish, Vegetation, Salinity, Water birds.

Marsh impoundments are widely used in coastal regions for improving wildlife habitat, aquaculture, water storage for agricultural irrigation and industrial uses, flooding marshes for mosquito control, and maintaining favorable water depths for navigation. Impoundments can be categorized on a basis of water level and salinity regimes into four types: permanently flooded with fresh water, manipulated fresh water, permanently flooded with brackish water, and manipulated brackish water. The vegetational and hydrological characteristics of each type of impoundment are discussed, and the effects of those characteristics on providing the habitat required for waterfowl, coots, gallinules, rails, wading birds, fur animals, alligators, freshwater fishes, estuarine fishes, and crawfish are described for coastal areas of the south Atlantic and Gulf coastal wetlands are primary factors regulating their value to fish and wildlife resources. Wildlife have preferences for different species of vegetation; consequently the plant species composition of an area often governs the animal species in the area. Hydrological factors such as salinity and tidal action may affect species tolerance or regulate access to the area. (Moore-SRC)
W81-00991

CONTRIBUTION OF WOODED SWAMPS AND BOTTOMLAND FORESTS TO ESTUARINE PRODUCTIVITY,
Louisiana State Univ., Baton Rouge. Coastal Ecology Lab.
J. W. Day, Jr., W. H. Conner, and G. P. Kemp.
In: Proceedings of the Gulf of Mexico Coastal Ecosystems Workshop, September 4-7, 1979, Port Aransas, Texas, Fore, P. L., and Peterson, R. D., Eds., Fish and Wildlife Service, Office of Environment, Report FWS/OBS-80/30, May, 1980, p 33-50. 6 Fig, 3 Tab, 26 Ref.

Descriptors: *Estuaries, *Swamps, *Forests, *Productivity, *Hydrology, *Ecology, Environmental gradient, Wetlands, Forest management, Flow, Nutrients, Wildlife, Land management, Water management(Applied), Bottom sediments, Canal construction, Channels, Vegetation.

The value of cypress swamps and bottomland forests for wildlife habitats and water regulation is well-recognized, but studies of the ecology and management of estuaries have rarely taken the role of these freshwater systems into consideration. Swamp forests of the southeastern United States are highly productive, and this high productivity is related to water flow. Chemical dynamics of swamps are very complex and strongly affected by local physical, hydrological and geological conditions. Higher water flow generally leads to more aerobic conditions, but this is affected by sediment type. The development of an oxygenated water column and sediment surface promotes the uptake of most inorganic forms. Swamps and bottomlands also have a marked effect on hydrological patterns. The vegetation, soils and topography of swamps result in the internal stabilization of often erratic water regimes. Swamps can affect estuarine productivity by serving as nursery habitat, by contributing nutrients, and by stabilizing hydrological conditions. Hydrology is a key consideration in both the management of swamps and swamp-estuary couplings. This includes land management as it affects water movement. Important areas for management include channelization, canal construction, spoil placement and water quality. (Moore-SRC)
W81-00993

RECENT ADVANCES IN OUR UNDERSTANDING OF SALT MARSH ECOLOGY,
Mississippi State Univ., Mississippi State. Dept. of Biological Sciences.
A. A. de la Cruz.
In: Proceedings of the Gulf of Mexico Coastal Ecosystems Workshop, September 4-7, 1979, Port Aransas, Texas, Fore, P. L., and Peterson, R. D., Eds., Fish and Wildlife Service, Office of Environment, Report FWS/OBS-80/30, May, 1980, p 51-65. 1 Fig, 55 Ref. NA79AA-D-000-49.

Descriptors: *Coastal marshes, *Salt marshes, *Ecology, *Detritus, Wildlife, Fish, Aquatic plants, Methodology, Productivity, Food chains, Cycling nutrients, Aquatic habitats, Decomposing organic matter, Estuarine environment, Marsh management, Conservation.

The functions of the salt marsh as a producer and reservoir of energy and nutrients, and as a vital habitat for fish and wildlife have been the subject of recent studies. The main issue in marsh grass productivity studies has been methodology: the traditional Harvest Method is still the most used procedure, but not without modifications. Variability in sampling procedures and differences in the methods and formulae have prevented reliable comparisons of marsh productivity data. The energy flow in the salt marsh follows a Y-shaped pathway, the grazing food chain and the detritus food chain. The relationship between the marsh and the secondary productivity of adjacent estuarine waters depends on: the production of abundant detritus from marsh plant material; the flux of the formed plant detritus into the water that inundates the marsh; and the assimilation of detritus particles and dissolved detritus by products into the food web that supports secondary production. Caloric and nutrient analysis data from decomposing detritus of estuarine marsh species indicate that energy and protein values remain high and in most cases increase, during decomposition to particulate detritus. Marshes appear to be both sinks and sources of organic material. Most of the recent conservation and management studies are related to the habitat functions of marshes for wildlife and as sites for fish and shellfish aquacultural development.
W81-00994

STUDIES OF FRESHWATER NEEDS OF FISH AND WILDLIFE RESOURCES IN NUECES-CORPUS CHRISTI BAYS, TEXAS,
Fish and Wildlife Service, Austin, TX.
For primary bibliographic entry see Field 2L.
W81-00996

ADAPTIVE ENVIRONMENTAL ASSESSMENT AND MANAGEMENT: AN OVERVIEW,
National Coastal Ecosystems, Team, Slidell, LA.
C. L. Cordes.
In: Proceedings of the Gulf of Mexico Coastal Ecosystems Workshop, September 4-7, 1979, Port Aransas, Texas, Fore, P. L., and Peterson, R. D., Eds., Fish and Wildlife Service, Office of Environment, Report FWS/OBS-80/30, May, 1980, p 185-189. 5 Ref.

Descriptors: *Planning, *Management, *Environmental effects, *Ecosystems, *Social aspects, *Economic impact, Alternative planning, Wildlife, Habitats, Resources development.

Resource managers and others concerned with protecting fish and wildlife, and their habitats are primarily involved in the environmental assessment process in a reactive review role. Planned developments are primarily designed within an economic context and rarely include a thorough consideration of environmental uncertainties. What often results are confrontations among representatives of various interest groups, most of whom had no opportunity to participate in the original project design. However, the methodologies of adaptive environmental assessment and management insure that environmental dimensions are integrated as equal elements with economic and social considerations at the very beginning of the development or management design process. Alternative management policies and development plans are generated in an atmosphere of open communication between developers and resource managers, and each alternative is collectively assessed for its environmental, economic, and social consequences. Flexibility is encouraged in project designs and management strategies so they may be adapted to unexpected ecological events and adjusted to benefit from information feedback throughout the development process. (Moore-SRC)
W81-00999

7. RESOURCES DATA

7B. Data Acquisition

TRACKING MOVEMENT AND IDENTIFICATION OF IN-STREAM FLOW NEEDS OF BROWN TROUT (SALMO TRUTTA) BY USE OF RADIO-ISOTOPES,
Wyoming Univ., Laramie. Dept. of Agricultural Engineering.
L. S. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-140568, Price codes: A04 in paper copy, A01 in microfiche. M.S. Thesis, December, 1980. 66 p, 9 Fig, 7 Tab, 51 Ref, 1 Append. OWRT B-038-WYO(2), 14-34-0001-8130.

Descriptors: *Fish behavior, *Brown trout, *Tracking techniques, Telemetry, Ice cover, *Ice-water interfaces, Wyoming, Streams, *Instream flow.

Medium-sized brown trout were tracked under surface ice in a small Wyoming foothills stream. A portable single-channel analyzer and NaI (Tl) crystal and photomultiplier tube were used to locate fish implanted with 0.5 milliCuries of Antimony-124. At each fish location water depth, ice depth, mean velocity, velocity at the water surface, and substrate velocity were measured. Substrate type and cover type were also recorded. Frequency of use of various depth, velocity, and substrate classes was determined. Predictive equations were also developed relating percent habitat excluded to various parameters.
W81-00753

THE ANALYSIS AND FATE OF ODOROUS SULFUR COMPOUNDS IN WASTEWATERS,
Los Angeles County Sanitation Districts, Whittier, San Jose Creek Water Quality Lab. CA.
R. L. Jenkins, J. P. Gute, S. W. Krasner, and R. B. Baird.
Water Research, Vol 14, No 5, p 441-448, May, 1980. 8 Fig, 2 Tab, 18 Ref.

Descriptors: *Sulfur compounds, *Waste water treatment, *Odor, *Instrumentation, *Pollutant identification, Analytical techniques, Calibrations, Gas chromatography, Flame photometry, Sampling, Industrial wastes, Water pollution sources, Treatment facilities.

An analytical system for odorous organosulfur compounds based on gas chromatography together with the sulfur specific flame photometric detector and capable of registering data in the ppb (ml odorant/ml air) range is presented. For storage and handling of standard compounds in the calibration system, a high vacuum line was found preferable to permeation tubes as being more representative of procedures used in field analysis, even though the vacuum apparatus is more complex. The use of gas syringes was another integral feature of the calibration system. A vacuum bulb apparatus for collecting ambient air at field sites is described. The waste-water sampling device allows the odor potential of a liquid sample to enter a relatively large evacuated chamber, thus releasing volatile sulfur compounds into the headspace. Gaseous mixtures have been found less susceptible to loss when kept in aqueous solutions. The analytical system was tested by tracing and characterizing an odor incident from a treatment plant to the industrial discharge source. In cases of major odor problems, the odorant can be determined both at the treatment facility and at the point of discharge. In low or moderate odor incidents, the major odorant may derive from long-chain mercaptan decomposition in aeration treatment facilities. Mercaptan loss and alteration may also make it impossible to trace the major odorant to its source of discharge chromatographically. (Just-FRC)
W81-00776

FLOW-THROUGH IN SITU METABOLIMETER FOR MONITORING OXYGEN CONSUMPTION, PRODUCTION AND DIFFUSION IN NATURAL WATERS,
Fisheries Research Inst., Szarvas (Hungary).
J. Olah, A Zsigri, and P. Szabo.
Water Research, Vol 14, No 5, p 553-556, May, 1980. 2 Fig, 1 Tab, 3 Ref.

Descriptors: *Measurement, *Oxygen requirements, *Bodies of water, On-site tests, Mathematical models, Instrumentation, Eutrophication, Respiration, Diffusion, Analytical techniques.

A flow-through in situ metabolimeter was developed to measure and monitor oxygen production, consumption and diffusion directly in highly eutrophic natural waters. The instrument works by the direct measurement of the daily rhythm of both respiration and diffusion, whereby it is possible to avoid or minimize the sources of error that occur with the analytical method based on the mathematical calculation of daily oxygen curves which has been proposed by Winberg and Odum for estimating oxygen turnover. Use of the instrument allows the investigator to work without empirical and theoretical constants and hypotheses which may vary according to water type and environmental and meteorological conditons. (Baker-FRC)
W81-00779

OBTAINING PRECISE ESTIMATES IN COLIFORM ENUMERATION,
College of Staten Island, NY. Dept. of Biology.
J. M. Fleisher, and R. T. McFadden.
Water Research, Vol 14, No 5, p 477-483, May, 1980. 1 Fig, 5 Tab, 19 Ref.

Descriptors: *Bioindicators, *Water quality, *Coliforms, Water pollution, Analytical techniques, Membranes, Filtration, Fermentation, Statistical methods, Water analysis.

The use of proper experimental design and improved techniques of coliform enumeration were combined to achieve a significant improvement in the quantitative use of coliforms as water-quality indicators. Samples of water were taken from a mildly polluted beach area on Staten Island. The membrane filtration technique was used to analyze the water samples. Density estimates were analyzed by a nested analysis of variance. Up to 95% of the variation in coliform density could be ascribed to actual temporal changes in density when replicated determinations were made. Replicated determinations allowed the construction of confidence intervals about the estimates which were considerably smaller than with single determinations when the variances of the density estimates were decreased. The theoretical superiority of the membrane filtration method of water quality analysis over the multiple tube fermentation method is discussed. (Baker-FRC)
W81-00782

UNCERTAINTY IN DISSOLVED OXYGEN PREDICTION DUE TO VARIABILITY IN ALGAL PHOTOSYNTHESIS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
G. M. Hornberger.
Water Research, Vol 14, No 4, p 355-361, April, 1980. 2 Fig, 4 Tab, 28 Ref.

Descriptors: *Mathematical models, *Photosynthetic oxygen, *Dissolved oxygen, *Algae, *Monte Carlo method, Oxygen sag, Primary productivity, Time series analysis, Statistical methods, Rivers, Water quality.

Monte Carlo methods were used to evaluate the contribution of variance in river community metabolism to overall uncertainty in predictions from dissolved oxygen (DO) models. The modification of the Streeter-Phelps equation used in this work includes the effect of community metabolism on the DO balance. The results of the Monte Carlo simulations show that not only is community metabolism an important element in water quality models, but because rates of photosynthesis and respiration cannot be taken as constant, uncertainty in parameters used to model community metabolism must be considered when probability distributions of DO in rivers are estimated. This conclusion was shown to be valid for a wide range of conditions and therefore applies to all but the most heavily polluted or highly turbid waters. The observed mean daily oxygen concentrations and corresponding standard deviations for the Mechums River, the South River and the Rappahannock River are 8.36 (0.42) mg/liter, 8.35 (0.35) mg/liter, and 8.85 (0.71) mg/liter, respectively. The fact that these observed standard deviations are closely approximated by the Monte Carlo results suggests that this simulation technique may be quite useful in practice provided an estimate for the mean and variance of P-R (productivity and reaeration) can be established. Use of a refined version of the oxygen balance equation that takes into account the diel variation in algal productivity shows that variance in dissolved oxygen in rivers is likely to be much larger than that predicted by models that use mean daily values of net production. (McKeon-FRC)
W81-00787

LABORATORY MANAGEMENT IN METHODS DEVELOPMENT,
PJB Labs./Jacobs Engineering, Pasadena, CA.
J. H. Taylor, C. Jackson, M. Miller, and D. R. Rushneck.
Journal of Environmental Science and Health. A, Vol 15, No 5, p 393-411, 1980. 10 Fig, 1 Tab, 2 Ref.

Descriptors: *Analytical techniques, *Gas chromatography, *Pollutant identification, Management, *Laboratories, Research and development, Chemical wastes, Testing procedures, Chemical industry, Laboratory tests.

Management practices employed in operations at an analytical laboratory are surveyed. The laboratory is responsible for the Organic Chemicals Verification Project, which is intended to provide analytical methodology, analytical data, and engineering information to characterize product/process wastewaters from EPA designated organic chemicals manufacturing plants. Using samples obtained at the plants, the laboratory is to analyze the in-process and waste streams for the Consent Decree Priority Pollutants. The organizational structure that is necessary to the operation is de-

tailed, and information is provided on the tools used to maintain operational control, such as status sheets, work order forms, and flow diagrams. The development of specific methods to meet the needs of specific projects is described. Three major managerial precepts used to accomplish the program include the use of a well-defined set of program objectives and priorities, assuming that technical solutions do exist and then locating and employing these technical solutions, and the development of methods that result in the simplest, most cost-effective analysis. Information is given on scheduling, logistics and cost accounting. To date, methods have been developed for a total of 78 streams from nine organic chemicals manufacturing plants. All but three of these streams were able to be monitored using only GC, not GC/MS methods. (Baker-FRC)
W81-00800

ZOOPLANKTON GRAZING AS A CONTROL MECHANISM IN ALGAL BLOOMS. A METHOD FOR THE STUDY OF THE EFFECT OF ALGAL TOXINS ON ZOOPLANKTON VERTICAL MIGRATION,
New Hampshire Univ., Durham. Dept. of Zoology.
J. F. Haney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-143364, Price codes: A03 in paper copy, A01 in microfiche. Water Resource Research Center, University of New Hampshire, Research Report 31, 1980. 24 p, 12 Fig, 9 Ref. OWRT-A-053-NH(1), 14-34-0001-9031.

Descriptors: *Zooplankton, *Algal toxins, *Vertical migration, *Chaoborus, *Daphnia, Aquatic life, Algal blooms, Toxins, Blue-green algae, Cyanophyta, Laboratory tests, Analytical techniques, Monitoring, *Diel migration, Echo sounder, Algal extract, Sonar recorder.

A method was developed to study the effect of blue-green alga toxins on the diel vertical migration of zooplankton. The usefulness of a high-frequency echo sounder to follow the diel movements of zooplankton was first tested in the field. Zooplankton were then placed in model lake systems (2.5 m high columns) in the laboratory. The echo sounder was modified to reduce the wave length of the sound output, thereby increasing the vertical resolution characteristics. Other modifications were also made to adapt the unit for use in these shallow systems. Maximum resolution was obtained by interfacing the sonar recorder with anoscilloscope so that the vertical position of individual zooplankton (Chaoborus and Daphnia) could be determined plus or minus 2.5 cm in a 200 cm column of water. Studies were conducted to calibrate the position and width of sonar traces against visual counts of the vertical distribution of animals in the columns. A monitoring system was designed to automatically track the movements of populations of zooplankton at 15 to 30 minute intervals over 24-hour periods. Size and shape of the columns should be matched to the sound characteristics of the sonar to avoid interference from multiple echos and artifacts caused by echos form the sides of the column. Preliminary studies of the effects of soluble toxins extracted from a bloom of blue-green algae indicate sublethal doses may alter the timing and extent of the vertical migration.
W81-00804

THE APPLICATION AND CONDUCT OF RING TESTS IN AQUATIC TOXICOLOGY,
Unilever Research Colworth/Welwyn Lab., Bedford (England).
M. J. How.
Water Research, Vol 14, No 4, p 293-296, April, 1980. 1 Tab, 8 Ref.

Descriptors: *Reviews, *Aquatic environment, *Testing procedures, *Toxicity, Lethal limits, Water pollution, Laboratory tests, Aquatic animals, Standards, Data collections, Networks, Analytical techniques.

In this letter to the editor, some aspects of the ring test (collaborative test) as applied to aquatic toxicology are reviewed. Ring tests generally employ several laboratories to determine the toxicity of a specific chemical to a certain organism under predetermined conditions. Standard methods are essential during ring tests, and each laboratory should be supplied with detailed testing procedures. It is recommended that the agreed-upon method be tested by one laboratory for sensitivity and practicality. Full ring tests are costly exercises. Compounds to be tested should be stable, representative of actual aquatic pollutants, and free of other contaminants. Strict adherence to time schedules is important for participating laboratories. Experimental design starts with mini-ring tests, followed by the actual ring test, then the reporting of LC50 values with 95% confidence limits. The organizational flow chart for ring tests is presented. It is stressed that these tests should only be conducted when necessary. (Geiger-FRC)
W81-00870

THE CAVTAT ACCIDENT: EVALUATION OF ALKYL LEAD POLLUTION BY SIMULATION AND ANALYTICAL STUDIES,
Istituto di Recercha sulle Acque Bari (Italy).
G. Tiravanti, A. Rozzi, M. Dall Aglio, W. Delaney, and A. Dadone.
Progress in Water Technology, Vol 12, No 1, p 49-65, 1980. 5 Fig, 4 Tab, 23 Ref.

Descriptors: *Lead, *Analytical techniques, *Model studies, Sediments, Sea water, Water pollution sources, Ships, Tetraethyl lead, Tetramethyl lead, Adriatic Sea.

Potential marine and coastal pollution by alkyl lead was evaluated by mathematical models, and specific field and laboratory procedures were developed for lead analysis in sea water. These strategies were developed following the sinking of the Yugoslavian cargo ship Cavtat to a depth of 93 m in the Adriatic Sea. The Cavtat carried 325 tons of tetraethyl and teramethyl lead. A mathematical model capable of simulating the diffusive and convective transport of released lead is presented, including the numerical solution. Analytical and numerical solutions of the diffusion model agree well for locations farther than 200 m downstream from the source. Specific field and laboratory procedures were developed for lead analysis in sea water. Sea water samples collected 100 m to several kilometers from the wreck gave lead values lower than 0.1 microgram/liter. The average lead concentrations in sediments were 15 ppm, which is normal for marine sediments. Lead levels were also normal in biota sampled before, during, and after recovery operations. (Small-FRC)
W81-00895

DETERMINATION OF NITRITE ION IN WASTE AND TREATED WATERS BY RESONANCE RAMAN SPECTROMETRY,
Meidensha Electric, Tokyo (Japan). Water Treatment Engineering Div.
For primary bibliographic entry see Field 5A.
W81-00927

DETECTION OF SALINE SEEPS.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-134843, Price codes: A06 in paper copy, A01 in microfiche. Completion Report for Office of Water Research and Technology from Water Resources Institutes in South Dakota, North Dakota and Montana, June, 1980. 101 p, 38 Fig, 20 Tab, 26 Ref. OWRT-B-043-SDAK(1), 14-34-0001-6117.

Descriptors: *Remote sensing, *Aerial photography, *Soil-water-plant relationships, *Saline water, *Seepage, Detection, Thermal radiation, Photogrammetry, Reflectivity, Seismic, Investigations, Electrical prospecting, Saline seeps, Growth rates, Montana, North Dakota, South Dakota.

The purpose of this study was to develop and test remote sensing techniques for detection of potential sites for seep development, for detection of seeps in an early stage of development and for monitoring the rate of growth of active seeps. Due to the regional nature of the problem, test sites were selected in Montana, North Dakota, and South Dakota. Aerial photography and thermal data were supported by ground truth on each site. The data collected did not relate well to digitized data from remote sensing products. Apparently the saline seep-soil-crop complex included variability not accounted for by the data collected. However, trained photointerpreters can delineate saline seeps using photo data products with reasonable degree of accuracy (70 to 80%) if they understand seep mechanisms, soils, and geology as well as photo interpretation methods. Incipient and latent seeps were difficult to identify regardless of the data products used for interpretation. Thermal imagery may be useful in locating wet zones that are potential seeps.
W81-00975

7C. Evaluation, Processing and Publication

SURFICIAL GEOLOGY OF RICHLAND QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. S. Miller.
Geological Survey Open-File Report 80-763 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, *Natural resources, *New York, Hydrogeology, Water wells, Water yield, Maps, *Oswego County,(NY).

The location and extent of 12 kinds of surficial deposits in Richland quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology potential for ground-water development at any specific location. (USGS)
W81-00813

SURFICIAL GEOLOGY OF PART OF CLEVELAND QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Syracuse Univ., NY.
E. H. Muller, and T. S. Miller.
Geological Survey Open-File Report 80-762 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, *Natural resources, *New York, Hydrogeology, Water wells, Water yield, Maps, *Oswego County(NY).

The location and extent of six kinds of surficial deposits in part of Cleveland quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for ground-water development at any specific location. (USGS)
W81-00814

SURFACE-WATER AVAILABILITY, GREENE COUNTY, ALABAMA,
Geological Survey, University, AL. Water Resources Div.
A. L. Knight, and M. E. Davis.
Alabama Geological Survey Map 149, 1980. 5 p, 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Surface water availability, *Streamflow, *Water quality, *Alabama, Runoff, Rainfall-runoff relationships, Flow rates, Water yield, Chemical analysis, Maps, Hydrologic data, Greene County(AL).

The average annual runoff originating in Greene County, Ala., is about 16 inches or 0.8 Mgal/d (million gallons per day) per square mile. The Black Warrior and Tombigbee Rivers, at their confluence, have a combined average flow of 14,100 Mgal/d; each has a median annual 7-day low flow in excess of 300 Mgal/d. The Sipsey River, along the northern boundary of the county, has an average flow in excess of 600 Mgal/d and a median annual 7-day low flow of 45 Mgal/d.

Streams within the county have average flows less than 60 Mgal/d and median annual 7-day low flows less than 2 Mgal/d. Surface water generally contains less than 120 mg/L (milligrams per liter) dissolved solids, less than 20 mg/L chloride, and generally is soft to moderately hard. (USGS)
W81-00815

GEOLOGY AND WATER AVAILABILITY OF CULLMAN COUNTY, ALABAMA,
Geological Survey, Louisville, KY. Water Resources Div.
R. J. Faust, and P. O. Jefferson.
Alabama Geological Survey Map 145, 1980. 30 p, 4 Fig, 3 Plates, 3 Tab, 13 Ref.

Descriptors: *Geology, *Groundwater, *Available water, *Surface waters, *Alabama, Aquifer characteristics, Water wells, Well data, Water yield, Hydrogeology, Streamflow, Flow rates, Water storage, Water quality, Chemical analysis, Water utilization, Maps, Hydrologic data, Cullman County(AL).

The Pottsville Formation of Pennsylvanian age underlies most of Cullman County in northern Alabama. It consists mostly of interbedded sandstones and shales that dip southward about 40 feet per mile. The Bangor Limestone of Mississippian age underlies the Pottsville and crops out in a few valleys along the northern boundary of the county. The principal source of ground water in the county is the Pottsville Formation. Sandstones of the Pottsville Formation underlying low topographic areas will yield as much as 200 gal/min (gallons per minute) to individual wells 200 feet deep or less in the southeastern part of the county and 25-100 gal/min in other parts of the county. Those underlying high topographic areas generally yield less than 5 gal/min. The average flow of streams in and adjoining Cullman County is about 1,500 Mgal/d (million gallons per day) which includes about 780 Mgal/d that originates in the county. Discharge from ground-water storage is small, and most streams cease to flow during extended dry periods. Sipsey Fork and Mulberry Fork are the only streams in and adjoining Cullman County that have median annual 7-day low flows that exceed 2 Mgal/d. Chemical analyses of water in the county indicate the water is suitable for most uses, but iron concentrations in ground water exceed 0.3 mg/L (milligrams per liter) in many places. Water use in Cullman County was estimated to average 5.6 Mgal/d in 1967. (USGS)
W81-00816

AVAILABILITY OF SURFACE WATER IN LOWNDES COUNTY, ALABAMA,
Geological Survey, University, AL. Water Resources Div.
J. R. Willmon.
Alabama Geological Survey Map 153, 1980. 7 p, 3 Fig, 1 Tab, 14 Ref.

Descriptors: *Available water, *Surface waters, *Streamflow, *Water quality, *Alabama, Flow rates, Rainfall-runoff relationships, Chemical analysis, Maps, Hydrologic data, Lowndes County(AL).

The flow of streams in Lowndes County, Ala., is highest during January through April and lowest during September and October. The Alabama River, which forms the northern boundary of the county, has an average flow of 16,800 Mgal/d (million gallons per day) at the northwest corner and a 7-day Q sub 2 (median annual 7-day low flow) of more than 1,000 Mgal/d. Big Swamp Creek near Lowndesboro has an average flow of 200 and a 7-day Q sub 2 of 0.1 Mgal/d. The 7-day Q sub 2 of each of the remaining streams within the county is less than 2 Mgal/d. Lowndes County receives about 1,770 Mgal/d (52 inches) of water from rain, of which 1,190 Mgal/d returns to the atmosphere through evapotranspiration, and the remaining 580 Mgal/d appears as runoff in streams. Water from streams in the county is moderately hard to hard, has a moderately low mineral content, and is suitable for most uses. (USGS)
W81-00817

SURFACE-WATER AVAILABILITY, TUSCALOOSA COUNTY, ALABAMA,
Geological Survey, University, AL. Water Resources Div.; and Geological Survey, Austin, TX. Water Resources Div.
A. L. Knight, and M. E. Davis.
Alabama Geological Survey Map 139, 1980. 12 p, 3 Fig, 1 Tab, 13 Ref.

Descriptors: *Surface water availability, *Streamflow, *Water quality, *Alabama, Flow rates, Water yield, Low flow, Water storage, Chemical analysis, Maps, Hydrologic data, Tuscaloosa County(AL).

The average annual runoff, about 1,270 Mgal/d (million gallons per day), originating in Tuscaloosa County, Ala., is equivalent to 20 inches or 0.95 Mgal/d per square mile. The Black Warrior and Sipsey Rivers, the largest streams in the county, have average flows of 5,230 Mgal/d and 580 Mgal/d, respectively, where they leave the county, and median annual 7-day low flows in excess of 150 Mgal/d and 35 Mgal/d, respectively. North River, Big Sandy Creek, and Hurricane Creek have average flows in excess of 100 Mgal/d and median annual 7-day low flows in excess of 2 Mgal/d. Surface water generally contains less than 100 mg/L (milligrams per liter) dissolved solids, less than 10 mg/L chloride, and is soft to moderately hard. Streams having the higher hardness and the higher dissolved-solids content are in eastern Tuscaloosa County. (USGS)
W81-00818

SURFACE-WATER AVAILABILITY, ST. CLAIR COUNTY, ALABAMA,
Geological Survey, University, AL. Water Resources Div.
J. R. Harkins.
Alabama Geological Survey Map 148, 1980. 10 p, 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Surface water availability, *Streamflow, *Water quality, *Alabama, Rainfall-runoff relationships, Flow rates, Low flow, Water yield, Water storage, Water temperature, Chemical analysis, Maps, Hydrologic data, St. Clair County(AL).

The Coosa River, the largest source of water in St. Clair County, Ala., has an average flow of 602 Mgal/d (million gallons per day) where it enters the county and 8,500 Mgal/d where it leaves the county, H. Neely Henry and Logan Martin Reservoirs, which extend along the eastern boundary of the county, have average storage capacities of 132,500 and 359,600 acre feet, respectively. Big Canoe Creek, which flows through the northern part of the county, is the largest stream in the county other than the Coosa River. It has an average flow of 210 Mgal/d at its confluence with H. Neely Henry Reservoir. Water in streams in St. Clair County is of good chemical quality and is suitable for most uses. Water in Big Canoe Creek is generally soft to moderately hard. Water in the Coosa River is generally soft. (USGS)
W81-00819

WATER AVAILABILITY OF BLOUNT COUNTY, ALABAMA,
Geological Survey, Louisville, KY. Water Resources Div.
R. J. Faust, and J. R. Harkins.
Alabama Geological Survey Map 141, 1980. 19 p, 4 Fig, 2 Plates, 4 Tab, 15 Ref.

Descriptors: *Available water, *Groundwater, *Surface waters, *Water quality, *Alabama, Aquifer characteristics, Water wells, Well data, Water yield, Hydrogeology, Streamflow, Flow rates, Rainfall-runoff relationships, Chemical analysis, Water utilization, Maps, Hydrologic data, Blount County(AL).

Ground water in Blount County, Ala., is obtained mostly from limestone and dolomite aquifers along the Sequatchie anticline and Murphrees Valley anticline and from sandstone aquifers in Sand Mountain and Blount Mountain synclinal areas. Wells tapping some limestone and dolomite aquifers produce as much as 1.4 Mgal/d (million gallons per day). Wells completed in sandstone of the Pottsville Formation underlying lower topographic areas may produce as much as 0.3 Mgal/d, but those completed in sandstone underlying higher topographic areas produce lesser quantities. Surface-water resources were appraised by use of average flow and 7-day Q2 (median annual 7-day minimum flow). An average flow of about 640 Mgal/d or about 1 Mgal/d per square mile originates in the county. Streamflow during low flow conditions is small; only three streams have 7-day Q2's that exceed 2 Mgal/d. Estimates of storage requirements are provided for sustained draft rates of 25 to 50% of the average flow. Water from aquifers and streams in Blount County is generally of suitable chemical quality for most uses. Water from the Pottsville Formation generally contains iron in excess of 0.3 milligram per liter and water from limestone and dolomite aquifers and from some streams during low flows is moderately hard to hard and may need treatment for certain uses. Water use in the county was about 3.2 Mgal/d in 1968 and 46 Mgal/d was diverted for use outside the county. (USGS)
W81-00820

WATER AVAILABILITY, SHELBY COUNTY, ALABAMA,
Geological Survey of Alabama, University.
V. M. Shamburger, and J. R. Harkins,.
Alabama Geological Survey Map 140, 1980. 32 p, 3 Fig, 3 Tab, 15 Ref.

Descriptors: *Available water, *Groundwater, *Surface waters, *Water quality, *Alabama, Aquifer characteristics, Water wells, Well data, Water yield, Hydrogeology, Streamflow, Flow rates, Rainfall-runoff relationships, Chemical analysis, Water utilization, Maps, Hydrologic data, Shelby County(AL).

The largest sources of ground water in Shelby County, Ala., are limestone and dolomite aquifers which are potential sources of about 0.5 Mgal/d (million gallons per day) per well. The most favorable well sites are in valleys or low topographic areas and adjacent to faults. Yields of wells rarely increase at depths greater than 350 feet except in fractured zones along faults. The major sources of surface water are the Coosa and Cahaba Rivers. The Coosa River is impounded by Lay Dam, which forms a lake of 145,000 acre-feet of water at elevation 396 feet above mean sea level. The Coosa and Cahaba Rivers have average flows of 9,400 Mgal/d and 400 Mgal/d, respectively at their lower reaches in the county. The Coosa River will provide more than 1,000 Mgal/d; whereas, the Cahaba River, Shoal Creek, and Buck Creek along their lower reaches in the county are each capable of providing water at the rate of 10 Mgal/d or more without storage. The county has an average annual precipitation of 54 inches of which about 20 inches runs off in streams. The 20 inches of runoff is equivalent to 800 Mgal/d or 1.0 Mgal/d per square mile. Ground water is of suitable chemical quality for most uses, but water from some sources may be objectionable for certain uses because of hardness or iron content. Surface water is of suitable chemical quality for most uses. Water use in the county in 1969 was estimated to be 5.6 Mgal/d, which is insignificant when compared to the total available supply. (USGS)
W81-00821

WATER AVAILABILITY IN CHILTON COUNTY, ALABAMA,
Geological Survey of Alabama, University. Water Resources Div.
J. S. Ellard, and J. R. Willmon.
Alabama Geological survey Map 146, 1980. 16 p, 3 Fig, 2 Plates, 3 Tab, 12 Ref.

Descriptors: *Available water, *Groundwater, *Surface waters, *Water quality, *Alabama, Aquifer characteristics, Water wells, Well data, Water yield, Hydrogeology, Streamflow, Flow rates, Chemical analysis, Water utilization, Maps, Hydrologic data, Chilton County(AL).

The largest sources of water in Chilton County, Ala., are sand, limestone, and dolomite aquifers,

and the Coosa River and Mulberry Creek. The principal sand aquifer in the southwestern part of the county will yield 0.5 to 1.0 Mgal/d (million gallons per day) per well. Limestone and dolomite aquifers in the northwestern part generally will yield less than 0.5 Mgal/d per well but locally will yield 0.5 Mgal/d or more. Metamorphic-rock aquifers in northern and eastern parts of the county generally yield less than 0.1 Mgal/d to individual wells. Wells developed in the principal sand aquifer range in depth form less than 100 feet along the northern margin of the aquifer to about 800 feet in the southwest corner of the county. Wells developed in limestone, dolomite, and undifferentiated metamorphic-rock aquifers are rarely drilled deeper than 300 feet. The Coosa River has an average flow of 10,100 Mgal/d and a 7-day Q sub 2 that exceeds 1,000 Mgal/d in the southeast corner of the county. Mulberry Creek, where it flows out of the county, has an average flow of about 180 Mgal/d and an estimated 7-day Q sub 2 of 34 Mgal/d. Water from aquifers and streams in Chilton County is generally of suitable chemical quality for most uses. Water from sand aquifers and metamorphic-rock aquifers is generally soft to moderately hard and locally contains iron in excess of 0.3 mg/L (milligram per litre). Water from limestone and dolomite aquifers is generally moderately hard to hard and has an iron content that is less than 0.3 mg/L. Water from streams has a low dissolved-solids content and is soft. The estimated use of water in Chilton County in 1969 was about 3 Mgal/d which is less than 1% of the quantity available. (USGS)
W81-00822

MAP SHOWING GROUND-WATER CONDITIONS IN THE CANYON DIABLO AREA, COCONINO AND NAVAJO COUNTIES, ARIZONA--1979,
Geological Survey, Tucson, AZ. Water Resources Div.
C. L. Appel, and D. J. Bills.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.50 in paper copy, 50 cents in microfiche. Geological Survey Open-File Report 80-747 (WRI), May, 1980. 1 Sheet, 9 Ref.

Descriptors: *Maps, *Groundwater, *Aquifer characteristics, *Water wells, *Water quality, Water levels, Specific conductivity, Fluorides, Arizona, Coconino County(AZ), Navajo County(AZ), Canyon Diablo area(AZ).

The Canyon Diablo area includes about 1,400 square miles in northeastern Arizona. The main source of ground water is the Coconino aquifer, which includes the Kaibab Limestone, the Coconino Sandstone, and the upper member of the Supai Formation. In places the alluvium and volcanic rocks yield water to wells and springs. Information on the map includes altitude of the water level, depth to water, and specific conductance and fluoride concentration in the water. Scale 1:125,000. (USGS)
W81-00823

INDEX OF STREAMFLOW AND WATER-QUALITY RECORDS TO SEPTEMBER 30, 1978, ARCTIC SLOPE ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
P. J. Still.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-554, 1980. 18 p, 1 Fig, 1 Tab.

Descriptors: *Alaska, *Streamflow, *Water quality, *Data collections, Streams, Gaging stations, Sites, Drainage area, *Artic Slope(AK).

This report, which is one of a series of reports for Alaska, lists stations in Arctic Slope, Alaska, at which streamflow and water quality data have been collected by the U.S. Geological Survey. Included are a hydrologic subregion map of Arctic Slope, Alaska, and a table listing the types of data collected and periods of record. (USGS)
W81-00824

INDEX OF STREAMFLOW AND WATER-QUALITY RECORDS TO SEPTEMBER 30, 1978, SOUTH-CENTRAL ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
P. J. Still.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $7.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-600, 1980. 54 p, 1 Fig, 1 Tab.

Descriptors: *Alaska, *Streamflow, *Water quality, *Data collections, Streams, Gaging stations, Sites, Drainage area, *South-central Alaska.

This report, which is one of a series of reports for Alaska, lists stations in south-central Alaska at which streamflow and water quality data have been collected by the U.S. Geological Survey. Included are a hydrologic subregion map of south-central Alaska and a table listing the types of data collected and periods of record. (USGS)
W81-00825

INDEX OF STREAMFLOW AND WATER-QUALITY RECORDS TO SEPTEMBER 30, 1978, YUKON BASIN, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
P. J. Still.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $5.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-552, 1980. 41 p, 1 Fig, 1 Tab.

Descriptors: *Alaska, *Streamflow, *Water quality, *Data collections, Streams, Gaging stations, Sites, Drainage area, *Yukon Basin(AK).

This report, which is one of a series of reports for Alaska, lists stations in Yukon Basin, Alaska, at which streamflow and water quality data have been collected by the U.S. Geological Survey. Included are a hydrologic subregion map of Yukon Basin, Alaska, and a table listing the types of data collected and periods of record. (USGS)
W81-00826

INDEX OF STREAMFLOW AND WATER-QUALITY RECORDS TO SEPTEMBER 30, 1978, SOUTHWEST ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
P. J. Still.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $2.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-551, 1980. 13 p, 1 Fig, 1 Tab.

Descriptors: *Alaska, *Streamflow, *Water quality, *Data collections, Streams, Gaging stations, Sites, Drainage area, *Southwest Alaska.

This report, which is one of a series of reports for Alaska, lists stations in southwest Alaska, at which streamflow and water quality data have been collected by the U.S. Geological Survey. Included are a hydrologic subregion map of southwest Alaska, and a table listing the types of data collected and periods of record. (USGS)
W81-00827

INDEX OF STREAMFLOW AND WATER-QUALITY RECORDS TO SEPTEMBER 30, 1978, NORTHWEST ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
P. J. Still.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $2.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-533, 1980. 19 p, 1 Fig, 1 Tab.

Descriptors: *Alaska, *Streamflow, *Water quality, *Data collections, Streams, Gaging stations, Sites, Drainage area, *Northwest Alaska.

This report, which is one of a series of reports for Alaska, lists stations in northwest Alaska at which streamflow and water quality data have been collected by the U.S. Geological Survey. Included are a hydrologic subregion map of northwest Alaska and a table listing the types of data collected and periods of record. (USGS)
W81-00828

INDEX OF STREAMFLOW AND WATER-QUALITY RECORDS TO SEPTEMBER 30, 1978, SOUTHEAST ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
P. J. Still.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-698, 1980. 26 p, 1 Fig, 1 Tab.

Descriptors: *Alaska, *Streamflow, *Water quality, *Data collections, Streams, Gaging stations, Sites, Drainage area, *Southeast Alaska.

This report, which is one of a series of reports for Alaska, lists stations in southeast Alaska at which streamflow and water quality data have been collected by the U.S. Geological Survey. Included are a hydrologic subregion map of southeast Alaska and a table listing the types of data collected and periods of record. (USGS)
W81-00829

WATER RESOURCES DATA FOR WYOMING, WATER YEAR 1979--VOLUME 1. MISSOURI RIVER BASIN,
Geological Survey, Cheyenne, WY. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-103129, Price codes: A09 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WY-79-1, July, 1980. 642 p, 9 Fig.

Descriptors: *Wyoming, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Missouri River basin(WY).

Water resources data for the 1979 water year for Wyoming consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. Volume 1 of this report contains discharge records for 166 gaging stations; stage only records for 1 lake; stage and contents for 11 lakes and reservoirs; water quality for 116 gaging stations, 101 ungaged stations, 70 wells and springs; and water levels for 36 observation wells. Also included are 75 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. This data represents that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Wyoming. (USGS)
W81-00833

WATER RESOURCES DATA FOR IDAHO, WATER YEAR 1979--VOLUME 1. GREAT BASIN AND SNAKE RIVER BASIN ABOVE KING HILL.
Geological Survey, Boise, ID. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120909, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report ID-79-1, September, 1980. 385 p, 12 fig.

Descriptors: *Idaho, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Great Basin(ID), *Snake River basin(ID).

Water resources data for the 1979 water year for Idaho consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report in two volumes contains discharge records for 183 gaging stations; stage only records for 2 gaging stations; stage for 6 lakes; contents for 23 lakes and reservoirs; water-quality for 91 gaging stations, 42 partial-record stations, and 173 wells; and water levels for 388 observation wells. Also included are data for 57 crest-stage partial-record stations and 191 low-flow partial-record stations. Additional water data were collected at various sites, not involved in the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Idaho. (USGS)
W81-00834

WATER RESOURCES DATA FOR IDAHO, WATER YEAR 1979--VOLUME 2. UPPER COLUMBIA RIVER BASIN AND SNAKE RIVER BASIN BELOW KING HILL.
Geological Survey, Boise, ID. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120917, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report ID-79-2, September, 1980. 345 p.

Descriptors: *Idaho, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Upper Columbia River basin(ID), *Snake River basin(ID).

Water resources data for the 1979 water for Idaho consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report in two volumes contains discharge records for 183 gaging stations; stage only records for 2 gaging stations; stage for 6 lakes; contents for 23 lakes and reservoirs; water-quality for 91 gaging stations, 42 partial-record stations, and 173 wells; and water levels for 388 observation wells. Also included are data for 57 crest-stage partial-record stations and 191 low-flow partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Idaho. (USGS)
W81-00835

SURFICIAL GEOLOGY OF TEXAS QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Syracuse University, NY.
E. H. Muller, and T. S. Miller.
Geological Survey Open-File Report 80-760 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, *Natural resources, *New York, Hydrogeology, Water wells, Water yield, Maps, Oswego County(NY).

The location and extent of nine kinds of surficial deposits in Texas quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for groundwater development at any specific location. (USGS)
W81-00837

8. ENGINEERING WORKS

8A. Structures

THE DESIGN AND CONSTRUCTION OF THE P K LE ROUX DAM,
Department of Water Affairs, Pretoria (South Africa). Engineering Dept.
A. G. Davies.
The Civil Engineer in South Africa (Johannesburg), Vol 20, No 10, p 249-259, October, 1978. 15 Fig, 12 Ref.

Descriptors: *Dam design, *Construction, *Engineering geology, Concrete-dams, Dams, Dam foundation, Flood control, Overflow, Seepage, Sediment control, Rock mechanics, Design flood, Topography, Structural behavior, Hydroelectric power, River flow, Erosion, Scour, Statistics, South Africa.

The logistics, engineering, and geological factors involved in the design and construction of the P K le Roux Dam, Orange River Project, South Africa, is described. It is South Africa's highest and second largest dam, 108 m high with a crest length of 770 m and a full supply capacity of 3,255 million cubic meters of water. The location is about 124 km downstream of the Hendrik Verwoerd Dam. The dam was constructed on a dolerite sill in a deep narrow gorge. The meridians of the arch are logarithmic spirals symmetrical about an axis down river and the radius of curvature increases from crown to flanks. The dam is exposed to flash floods and it has a free overspill with a crest length of 212 m. The overspill apron extends downstream to prevent scour of the foundation. Silt outlet and a gated spillway are provided for efficient operation and maintenance. The instrumentation, concreting, cooling system, and hydroelectric power station of the dam are described in detail. The construction phases of the dam are outlined and the methods used for river diversion are explained. All engineering statistics and construction dates are listed. (Sidney-IPA)
W81-00794

8B. Hydraulics

THE IMPACT OF PUMPED STORAGE OPERATION ON THE VERTICAL TEMPERATURE STRUCTURE IN A DEEP LAKE: A MATHEMATICAL MODEL,
Eidgenoessische Anstalt fuer Wasservorsorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
D. M. Imboden.
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J.P. Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 125-146. 5 Fig, 5 Tab, 13 Ref.

Descriptors: *Pumped storage, *Mathematical models, *Limnology, *Thermal stratification, *Hydroelectric plants, Climates, Reservoirs, Thermoclines, Water temperature, Heat balance, Mixing.

A mathematical model of vertical temperature structure is presented for a typical pumped storage power plant system where water is cycled between a natural lake (lower reservoir) and an artificial (upper) reservoir. Thermocline models, wind mixing, vertical diffusion, meterorological forces, pumped storage operation, thermal energy balance, and heat exchange in the upper reservoir are considered in developing the pumped storage model. In order to demonstrate the synergetic effects of the perturbations introduced into a lake by a pumped storage power plant, the natural temperature and mixing regime of Lake Lucerne is exposed to a hypothetical pumped storage power plant. The main effect of pumped storage lies in a delay of the onset of the stagnation period from mid March to mid May. At the surface the warming of the water is delayed by a little more than one month. The seeming paradox of lower surface temperature and larger heat content is resolved by the permanent existence of a thermocline between 8 and 12 m depth. The pumped storage plant causes an increase in the vertical heat transport into the lake accompanied by a slight temperature increase below 8 m. (Moore-SRC)
W81-00849

COMBINED USE OF PHYSICAL AND MATHEMATICAL MODELS IN EVALUATING THE EFFECTS OF PUMPED STORAGE OPERATION ON THE THERMAL STRUCTURE OF A RESERVOIR,
Worcester Polytechnic Inst., Holden, MA. Alden Research Labs.
D. N. Brocard, E. E. Adams, and S. Bloss.
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J.P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 147-157.

Descriptors: *Pumped storage, *Hydroelectric plants, *Model studies, *Thermal stratification, *Limnology, Mathematical models, Reservoirs, Water temperature, Mixing, Thermoclines.

The possible effects of a proposed pumped storage project on the thermal structure of its lower reservoir were investigated by use of the combination of a physical model and a mathematical model. Pumped storage operations were simulated in a prestratified scale model of the proposed lower reservoir and measured temperatures were used to calibrate the mixing and selective models used in the mathematical simulation. The latter was then used to predict the thermal regime of the reservoir with pumped storage. The major effect of pumped storage is to mix the upper layers of the reservoir resulting in a deepening of the epilimnion. During the spring and early summer near surface temperatures are increased by 1 to 2 degrees C while at middle depths temperatures are increased substantially. Below the level of the tailrace there is little change. During the late summer the surface begins to cool, convective mixing takes place, and the thickness of the epilimnion increases rapidly. The increased heat content now results in surface temperatures which are higher during pumped storage operation than under natural conditions. There is also a larger temperature difference below the tailrace. (Moore-SRC)
W81-00850

EFFECTS OF VERTICAL SCALE DISTORTION ON THE PERFORMANCE OF THERMAL-HYDRAULIC MODELS OF PUMPED STORAGE SYSTEMS,
West Virginia Univ., Morgantown. Dept. of Mechanical Engineering and Mechanics.
R. A. Bajura, and S. H. Schwartz.
In: Proceedings of the Clemson Workshop on Environmental Impacts of Pumped Storage Hydroelectric Operations, May 15-16, 1979, Clemson, South Carolina, Clugston, J.P., Ed., Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-80/28, April, 1980, p 158-176. 9 Fig, 8 Ref.

Descriptors: *Pumped storage, *Hydroelectric plants, *Model studies, *Thermal stratification, Reservoirs, Water temperature, Limnology, Hydraulics.

Since most reservoirs are exceedingly broad compared to their depth, the scaled depth in a thermal-hydraulic model may be unacceptably small. One solution to this modeling dilemma is the use of a distorted model in which the vertical depth is exaggerated. A model of a hypothetical pumped storage facility was constructed at a scale ratio of 1:240 for the undistorted case. Two other models were constructed with distortion ratios of 3 and 5. Tests were conducted for a range of Froude numbers from 2 to 10 for both the generation and pumpback modes of operation for the three tailrace models. The amount of warm water injected was varied between 7% and 25% of the initial volume of the model reservoir. It is concluded that the effect of vertical scale distortion on the perform-

ance of a thermal-hydraulic model of a pumped storage reservoir outlet is significant. Distorted models are characterized by a greater degree of mixing and lower surface temperatures as compared to the undistorted model. (Moore-SRC)
W81-00851

8D. Soil Mechanics

DEVELOPMENT OF PHREATIC SURFACES IN EARTH EMBANKMENTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
C. S. Desai, and T. Kuppusamy.
Report VPI-E-80.22 to Water and Power Resources Service, May, 1980. 54 p, 34 Fig, 12 Ref.

Descriptors: *Free surfaces, *Model studies, *Embankments, *Earth dams, *Seepage, Earthworks, Water levels, Reservoirs, Hydraulic models, Soil stability, Soil water, Computer models.

Transient or time dependent movements in water levels caused by rise and drawdown in the reservoir can influence significantly the stability and integrity of dams or embankments that retain the reservoir. The fluctuations in water level cause transient seepage in the dam and such flow is accompanied by the existence of the free or phreatic surface. The computer code called SEEP-2DFE has been modified, and used to study free surface locations due to a rise in reservoir level. In order to verify the predictions from finite element computations, a laboratory model was designed and constructed, using glass beads to simulate soil media. Comparisons between predictions and observations were satisfactory. A parametric study was performed by using the code to investigate the possibility of the overshooting phenomenon in a zoned dam. It indicated that in the upstream shell and core regions, the phreatic surface rose monotomically and did not show overshooting. A small amount of overshooting was seen in the downstream shell area. (Moore-SRC)
W81-00758

8I. Fisheries Engineering

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Wyoming Univ., Laramie. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 7B.
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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 14, NUMBER 7
APRIL 1, 1981

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

VOLUME 14, NUMBER 7
APRIL 1, 1981

W81-01001 -- W81-01203

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Office of Water Research and Technology. The cumlative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

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08 ENGINEERING WORKS

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

CHLORIDE IONS IN AQUEOUS SOLUTIONS,
Bristol Univ. (England). H. H. Wills Physics Lab.
S. Cummings, J. E. Enderby, G. W. Neilson, J. R. Newsome, and R. A. Howe.
Nature, Vol 287, No 5784, p 714-716, October 23, 1980. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Aqueous solutions, *Chlorides, *Sodium chloride, *Electrolytes, *Calcium chloride, Lithium chloride, Rubidium chloride, Nickel chloride, Barium chloride.

The isotopic substitution method was used to study the geometry of chloride ion coordination (hydration) in aqueous solutions of the following counter-ions: lithium, sodium, rubidium, calcium, nickel, and barium. Salts composed of both C135 and C137 isotopes were dissolved in heavy water and their scattering lengths measured: C135 salts, 1.17 fm; C137 salts, 0.35 fm. Results indicated that chloride ion hydration is essentially independent of both cation and ionic strength with the exception of Ni(++). Therefore, counter-ion influences may be considered second-order, leading to a simplification in the theory of solutions. However, it is possible that highly concentrated solutions of transition metal ions may be exceptions to these findings. (Cassar-FRC)
W81-01049

2. WATER CYCLE

2A. General

WATER RESOURCES OF BOULDER COUNTY, COLORADO,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-01031

MODELING THE RUNOFF PROCESS IN URBAN AREAS,
Purdue Univ., Lafayette. School of Civil Engineering.
J. W. Delleur, and S. A. Dendrou.
CRC Critical Reviews in Environmental Control, Vol 10, No 1, p 1-64, July, 1980. 18 Fig, 6 Tab, 204 Ref.

Descriptors: *Urban runoff, *Model studies, *Urban drainage, *Storm runoff, Environmental effects, Rainfall-runoff relationships, Water pollution, Reviews, Evaluation, Distribution patterns, *Urban hydrology, Design storm.

The major works critically reviewed pertain to the large, recent, specialized literature concerned with the study of storm runoff and its environmental effects. The effort is made at producing a synthesis of the state-of-the-art in modeling urban runoff, with emphasis on identifying the limitations, current needs, and trends of future work. After a discussion of precipitation and its abstraction over urban areas, the models of physical processes are presented; those related to the quantity and quality (pollutants) are discussed separately. Also a distinction is made between the lumped parameter models and the distributed parameter models. The most important development in urban hydrology during the last decade has been the development of sophisticated large-scale simulation models of storm drainage systems. Finally the economics of urban storm-drainage systems are addressed and conclusions and future trends are presented.
W81-01153

2C. Snow, Ice, and Frost

RECONNAISSANCE SNOW SURVEY OF THE NATIONAL PETROLEUM RESERVE IN ALASKA, APRIL-MAY 1979,
Geological Survey, Anchorage, AK. Water Resources Div.
W. J. Glude, and C. E. Sloan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-225006, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-49, 1980. 13 p, 7 Fig, 1 Tab, 3 Ref.

Descriptors: *Snow surveys, *Evaluation, *Alaska, *Snow management, *Snowfall, Precipitation(Atmospheric), Sampling, Snow cover, Snowmelt, Water equivalent, Snowpacks, Avalanches, Remote sensing, *National Petroleum Reserve in Alaska.

Moderately low snowfall and an early and abrupt spring thaw resulted in removal of most of the snow cover from the National Petroleum Reserve in Alaska (NPRA) before the snow survey of April 30 through May 2, 1979. Logistical problems and lack of snow permitted sampling at only seven sites. The average snow depth (0.263 meter) was approximately 60% of that measured in the 1977 and 1978 surveys. Snow density in 1979 averaged 337 kilograms per cubic meter and water equivalent averaged 0.088 meter. These two values are about 110% and 70%, respectively, of values for those characteristics in 1977-78. The average temperature of -5.2 Celsius at the base of the snowpack was about 6 Celsius higher than in the previous surveys. Extensive recent slab avalanche activity was noted in the Brooks Range. (USGS)
W81-01187

2D. Evaporation and Transpiration

PROGRAMS REVAP AND WEVAP FOR ESTIMATING AREAL EVAPOTRANSPIRATION AND LAKE EVAPORATION FROM CLIMATOLOGICAL OBSERVATIONS,
National Hydrology Research Inst., Ottawa (Ontario).
F. I. Morton, R. Goard, and J. Piwowar.
NHRI paper No 12, 1980. 56 p, 4 Fig, 1 Tab, 5 Ref, 3 App.

Descriptors: *Evapotranspiration, *Lake evaporation, *Climatic data, Data collections, *Computer models, Areal hydrology, Potential, Documentation, Input, Air temperature, Dew point temperature, Sunshine duration, Forecasting.

This report contains the necessary documentation for application of the computer programs REVAP and WEVAP. Estimates of areal evapotranspiration or lake evaporation for periods of 5 days to 1 month are made from routinely published records of air temperature, dew point temperature and sunshine duration. Both models are based on a complementary relationship between areal and potential evapotranspiration. Details of preparation of the input card deck as well as a sample output are discussed. Included in the appendices are the FORTRAN program listing for program REVAP and documentation of the comparable Hewlett-Packard HP-67 hand-held calculator program. (WATDOC)
W81-01017

WATER MOVEMENT THROUGH STANDS OF LODGEPOLE PINE FOREST IN WYOMING,
Wyoming Univ., Laramie. Dept. of Botany.
D. H. Knight, and T. J. Fahey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-152027, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, University of Wyoming Project Completion Report, November, 1980, 75 p, 11 Fig, 9 Tab, 92 Ref. OWRT-B-036-WYO(1), 14-34-0001-7202.

Descriptors: *Transpiration, Water loss, *Lodgepole pine trees, *Forests, *Flow, Forecasting, Soil-water movement, Snowmelt, Phytometers, Rainfall, Model studies, Weather, *Wyoming.

Various aspects of water movement through lodgepole pine forest were studied. The results, presented in 3 separate chapters, can be summarized as follows: (1) stands with very different tree density and biomass may have very similar leaf area indices (6.5 and 6.7) and clear day transpiration rates (3.3 and 3.4 mm day super -1, measured with whole-tree potometers); (2) whole-tree potometers can be used for estimating short-term transpiration when leaf water potential is not limiting leaf conductance; (3) individual tree basal area and maximum observed 24-hr potometer uptake were highly correlated in the stands studied, with the largest trees (20-26 cm dbh) transpiring 40-44 liters on clear days in early summer; (4) on overcast days potometer uptake was reduced by 30-44%; during rainy periods uptake was reduced to nearly zero; (5) predicted outflow, using a computer simulation model developed during this study, appeared to be more sensitive to variation in soil waterholding capacity than to stand leaf area, but the combined effects of forest LAI on water uptake during snowmelt, timing and duration of snowmelt, and soil water drawdown in summer and fall resulted in significant effects on predicted outflow; and (6) overnight frost in the spring reduced leaf conductance the following day, and midday leaf conductance was highly correlated with the mean temperature of subfreezing nights.
W81-01175

2E. Streamflow and Runoff

PREDICTING THE EFFECTS OF STORM SURGES AND ABNORMAL RIVER FLOW ON FLOODING AND WATER MOVEMENT IN MOBILE BAY, ALABAMA,
Alabama Univ., University.
G. C. April, and D. C. Raney.
In: Estuarine and Wetland Processes, P. Hamilton and K. B. MacDonald (Eds.), Plenum Publishing Corp., New York, NY, 1980. p 217-245. 10 Fig, 6 Tab, 9 Ref, 1 Append. OWRT-A-061-ALA(3).

Descriptors: *Model studies, Mathematical models, *Forecasting, *Storm surge, *Flooding, Water spreading, *Alabama, Experimental models, Climatic data, Mathematical studies, Computer models, Numerical analysis, Probability, Statistical methods, Storms, Hurricanes, Tropical cyclones, Storm water, Weather, Floodwater, Flood waves, Bays, *Mobile Bay(AL).

Recent numerical modeling activities of the Mobile Bay system under severe conditions were discussed. Results were presented in terms of changes that occur in water elevation and movement, and, in salinity distribution patterns when the Bay is subjected to river flooding inflows and storm surges. A river flood stage of 7000 cubic meters per second results in water behavior in the northern and central Bay portions that is totally governed by the fresh water inflow. A salinity level of five parts-per thousand (ppt) is restricted to the lower Bay region at a point 15 kilometers from the Main Pass. Usual salinity values under normal conditions in this area range from 15-20 ppt. A critical river flow rate of 8500 cubic meters per second was identified, at or above which saline water intrusion in the lower Bay becomes stabilized at 10 ppt on a line 6 kilometers north of the Main Pass. Conversely, large amounts of saline water enter the Bay under the storm surge conditions studied. Conditions used in the modeling exercise were typical of those caused by Hurricane Camille in 1969. In both cases, the model results were representative of Bay behavior. (Zielinski-IPA)
W81-01008

AERIAL INFRARED PHOTOGRAPHY FOR FLOOD PLAIN INVESTIGATIONS,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 7B.
W81-01055

QUALITY OF WATER IN THE BLACK RIVER NEAR DUNN, NORTH CAROLINA, AND GROUND-WATER LEVELS ADJACENT TO THE RIVER PRIOR TO CHANNEL EXCAVATION IN 1976-79,

Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 6A.
W81-01193

FLOOD OF JUNE 18, 1978, ON HONEY CREEK TRIBUTARY AT THORNVILLE, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
E. E. Webber, and R. I. Mayo.
Geological Survey Open-File Report 80-16 (WRI), 1980. 7 p, 2 Fig, 1 Tab, 3 Ref.

Descriptors: *Floods, *Ohio, *Rainfall-runoff relationships, *Streams, *Flash floods, Flood damage, Flood peak, Flood frequency, Flood recurrence interval, *Honey Creek tributary(OH), Thornville(OH).

A high-intensity summer rain estimated at 8 inches in 2 hours caused flooding on a small stream near Thornville, Ohio, destroying a culvert and highway fill on State Highway 188. Computation of peak discharges of 3,250 cubic feet per second above and 4,050 cubic feet per second below the culvert indicates a greater than 100-year flood. (USGS)
W81-01194

DEVELOPMENT OF A MODEL FOR ESTIMATING THE EXTENT OF RIVER FLOODING WITH SATELLITE AND IN SITU DATA,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 7B.
W81-01203

2F. Groundwater

MODEL EVALUATION OF THE HYDROGEOLOGY OF THE MORRIS BRIDGE WELL FIELD AND VICINITY IN WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 6A.
W81-01027

GROUND-WATER APPRAISAL OF THE FISHKILL-BEACON AREA, DUTCHESS COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
D. S. Snavely.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $7.50 in paper copy, $5.00 in microfiche. Geological Survey Open-File Report 80-437 (WRI), 1980. 14 p, 1 Fig, 3 Plates, 3 Tab, 4 Ref.

Descriptors: *Groundwater resources, *Aquifer systems, *Aquifer characteristics, *Groundwater availability, *New York, Geology, Water wells, Well data, Water yield, Hydrologic budget, Groundwater recharge, Discharge(Water), Water storage, Water utilization, Withdrawal, Groundwater potential, Chemical analysis, *Dutchess County(NY).

The most productive aquifers in the Fishkill-Beacon area, Dutchess County, N.Y., are the sand and gravel beds in the northeast corner of the area and along the valleys of Fishkill and Clove Creeks. The average yield of these aquifers to wells is 190 gal/min (gallons per minute). The most productive bedrock aquifer is limestone, which yields an average of about 150 gal/min. Shale and granite each yield an average of less than 35 gal/min. About 4 billion gallons of available ground water is estimated to be in storage in the sand and gravel aquifers in the area. The area withdraws an average of 3.3 Mgal/d (million gallons per day) of water in June, July, and August and 2 Mgal/d during the remainder of the year. (USGS)
W81-01028

USE OF GEOPHYSICAL LOGS TO ESTIMATE WATER-QUALITY TRENDS IN CARBONATE AQUIFERS,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7B.
W81-01029

WATER-RESOURCES RECONNAISSANCE OF THE SOUTHEASTERN PART OF ST. PAUL ISLAND, PRIBILOF ISLANDS, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 4A.
W81-01033

GEOLOGIC ASPECTS OF THE SURFICIAL AQUIFER IN THE UPPER EAST COAST PLANNING AREA, SOUTHEAST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-01038

GEOLOGY AND GROUND WATER IN NORTH-CENTRAL SANTA CRUZ COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-01044

GROUND-WATER LEVELS IN NEW MEXICO, 1977,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-01181

DIGITAL-SIMULATION AND PROJECTION OF HEAD CHANGES IN THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM, COASTAL PLAIN, NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
J. E. Luzier.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115768, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-11, May, 1980. 72 p, 32 Fig, 6 Tab, 33 Ref.

Descriptors: *Groundwater resources, *Model studies, *Hydrogeology, *Aquifer characteristics, *New Jersey, Computer models, Water supply, Pumping, Drawdown, Encroachment, Saline water, Water yield, Potentiometric level, Groundwater recharge, Hydrologic properties, Leakage, Transmissivity, Groundwater movement, Simulation analysis, Evaluation, Head loss, *Coastal Plain(NJ), *Potomac-Raritan-Magothy aquifer system.

A digital model was used to simulate the response of the Potomac-Raritan-Magothy aquifer system to pumping stresses during the 18-year period, 1956-73. The model was used to compute projected potentiometric heads and trends to the year 2000. Three sets of conditions were simulated: (1) no increase in groundwater extractions; (2) continued growth in groundwater extractions at the rate of 3% annually; and (3) continued growth in groundwater extractions at the rate of 3% annually, in conjunction with the activation of a freshwater head barrier in the fresh-salty water transition zone. Under the first set of conditions, further head reduction would cease over very large regions within two years. Under the second set of conditions, the broad cone of depression would broaden and deepen. Heads would range from 60 to 160 feet below mean sea level with declines after 1973 approaching 90 feet in some areas. The resultant steeper hydraulic gradients would accelerate the movement of salty ground water toward the pumping centers. If a freshwater head barrier were constructed across a 35-mile stretch in Gloucester, Camden, and Burlinton Counties, the total rates of injection needed would range from about 56 cubic feet per second in year 1984 to about 95 cubic feet per second in year 2000. Barrier recharge rates would be equivalent to about 20% of the ground water pumped. (USGS)
W81-01185

DEVELOPMENT AND USE OF A MATHEMATICAL MODEL OF THE SAN BERNARDINO VALLEY GROUND-WATER BASIN, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
W. F. Hardt, and C. B. Hutchinson.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $14.50 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 80-576 (WRI), September, 1980. 80 p, 19 Fig, 1 Plate, 8 Tab, 37 Ref.

Descriptors: *Model studies, *Mathematical models, *Aquifer characteristics, *Groundwater basins, *California, Hydrologic data, Finite element analysis, Hydrogeology, Groundwater movement, Artesian wells, Pumping, Drawdown, Artificial recharge, Natural recharge, Water level fluctuations, Potentiometric level, Transmissivity, Storage coefficient, Maps, *San Bernardino Valley(CA), Projections.

Part of the San Bernardino urbanized area in California overlies formerly swampy lands with a history of flowing wells. This area, upgradient from and adjacent to the San Jacinto fault, contains a zone in an alluvial ground-water basin that is under artesian pressure. Since 1945, withdrawals have exceeded recharge and caused head declines of more than 100 feet. Artificial recharge of imported water in the upgradient areas may cause groundwater levels to rise, which could cause abandoned but unplugged wells to resume flowing. If so, structures could be damaged. A two-layer Galerkin finite-element digital model was used for predicting the rate and extent of the rise in water levels from 1975 to 2000. Six hydrologic conditions were modeled for the basin. Artificial recharge of one-half entitlement and full entitlement from the California Aqueduct were each coupled with low, average, and high natural recharge to the basin. According to model predictions, the greatest water level rises will be along the San Bernardino front. This area encompasses the artificial recharge sites and also has a thick section of unsaturated sediments for storing ground water. The formerly swampy lands between Warm Creek and the Santa Ana River adjacent to the San Jacinto fault have little additional storage capacity, and water levels could rise to the land surface as early as 1983 under maximum recharge conditions and 1970-74 average pumping conditions. If pumping rates are reduced in the Warm Creek area, water levels may rise to land surface prior to the dates predicted by the model, regardless of the artificial-recharge program. (USGS)
W81-01186

SIMULATED EFFECTS OF A PROPOSED WELL FIELD ON THE GROUNDWATER SYSTEM IN THE SALT RIVER INDIAN RESERVATION, MARICOPA COUNTY, ARIZONA,
Geological Survey, Tucson, AZ. Water Resources Div.
P. P. Ross.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-503-W, April, 1980. 22 p, 7 Fig, 12 Ref.

Descriptors: *Model studies, *Simulation analysis, *Groundwater, *Aquifer characteristics, *Arizona, Hydrogeology, Irrigation wells, Water levels, Withdrawal, Pumping, Drawdown, Overdraft, Recharge, Digital computers, Computer models, *Maricopa County(AZ), Salt River Indian Reservation, Well field.

A finite-difference digital model was developed to simulate the effects of a proposed well field on the water levels in existing wells in the Salt River Indian Reservation, which is in the southeastern part of Paradise Valley in central Arizona. The

model area includes about 600 square miles in Paradise Valley and the adjoining Salt River Valley. In 1975 about 37,500 acre-feet of ground water was withdrawn for irrigation in the Salt River Indian Reservation. The proposed well field would withdraw as much as 45,000 acre-feet per year of additional irrigation water north of the Arizona Canal. The model was calibrated by using measured water-level declines for 1923-76 and simulated declines for 1946-75. The calibrated model was then used to predict water-level declines, based on projected amounts of pumpage, after 20 years of pumping. The rate of water-level decline would be an additional 2 to 6 feet per year in existing wells after 20 years of pumping in the proposed well field. The model was more sensitive to changes in pumpage distribution and in pumpage and recharge amounts than to changes in transmissivity and specific yield. (USGS)
W81-01191

APPROXIMATE ALTITUDE OF WATER LEVELS IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS IN THE HOUSTON AREA, TEXAS, SPRING 1979 AND SPRING 1980,
Geological Survey, Austin, TX. Water Resources Div.
R. K. Gabrysch.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $4.75 in paper copy, $2.00 in microfiche. Geological Survey Open-File Report 80-579, June, 1980. 4 Sheets, 1 Ref.

Descriptors: *Groundwater, *Water wells, *Water levels, *Potentiometric level, *Maps, Contours, Aquifers, Water level fluctuations, Texas, *Houston area(TX), Chicot aquifer, Evangeline aquifer.

These four maps show water levels in wells in the Houston, Texas, area in (1) the Chicot aquifer, spring 1979; (2) the Evangeline aquifer, spring 1979; (3) the Chicot aquifer, spring 1980; and (4) the Evangeline aquifer, spring 1980. Both the Chicot and Evangeline aquifers are composed of several sand layers with different potentiometric surfaces. These maps, however, show approximations of single potentiometric surfaces that represent composite hydraulic heads.
W81-01196

AVAILABILITY AND QUALITY OF GROUNDWATER, SOUTHERN UTE INDIAN RESERVATION, SOUTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-01197

2G. Water In Soils

THIRD-ORDER INTEGRAL RELATION BETWEEN SORPTIVITY AND SOIL WATER DIFFUSIVITY USING BRUTSAERT'S TECHNIQUE,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
J-Y. Parlange, R. D. Braddock, and I. Lisle.
Soil Science Society of America Journal, Vol 44, No 5, p 889-891, September-October, 1980. 1 Tab, 15 Ref.

Descriptors: *Diffusivity, *Soil water, *Sorption, Soil physics, Brutsaert's technique, Equations.

An improvement in the understanding of mathematical relationships between sorptivity and soil-water diffusivity is presented. This result can be used to predict soil-water diffusivity from sorptivity measurements in a wide range of soil conditions. Precision of this method is discussed for two general classes of soil-water diffusivities. (Cassar-FRC)
W81-01076

COMPARATIVE RESISTANCE OF THE SOIL AND THE PLANT TO WATER TRANSPORT,
Illinois Univ. at Urbana-Champaign. Dept. of Botany.
W. E. Blizzard, and J. S. Boyer.
Plant Physiology, Vol 66, No 5, p 809-814, November, 1980. 6 Fig, 2 Tab, 30 Ref.

Descriptors: *Plant physiology, *Water balance, Soil water, *Soil water movement, *Soil-water-plant relationships, *Flow resistance, Evapotranspiration, Groundwater potential, Mass transfer, Mathematical studies.

Resistance to water transport was compared in soils and plants. Direct measurements were made of soil, root, and leaf water potentials and the flux of water through the soil-plant system to the evaporation sites in the leaf. In measurements made in soybeans, with water being transported at a steady rate, water potential differences between root and leaf over the range of soil water potentials from -0.2 to -11 bars. As the water in the soil was being used up, water flow through both the soil and the plant decreased to one-tenth the maximum rate. However, both the soil and the plant resistance remained at a higher level than soil resistance to water transport over the entire range of soil water availability studied. It is suggested that, at least in young plants, the plant resistance is the largest resistance factor in the soil-plant system over the range of soil water likely to be encountered. Therefore, alterations in water transport characteristics of the plant could be a major factor on leaf water status and on the growth of plants in both moist and dry soils. (Baker-FRC)
W81-01082

A CLOSED-FORM EQUATION FOR PREDICTING THE HYDRAULIC CONDUCTIVITY OF UNSATURATED SOILS,
Science and Education Administration, Riverside, CA. Salinity Lab.
M. T. van Genuchten.
Soil Science Society of America Journal, Vol 44, No 5, p 892-898, September/October, 1980. 9 Fig, 1 Tab, 21 Ref.

Descriptors: *Hydraulic conductivity, *Soil water movement, *Diffusivity, Unsaturated flow, Mualem method, Burdine method, Mathematical models.

Hydraulic conductivity results obtained with the closed-form analytical expressions based on the Mualem model were compared with observed hydraulic conductivity data for five soils with widely varying hydraulic properties. In 4 of 5 cases, the hydraulic conductivity was predicted well. A reasonable description of the soil-water retention curve at low water contents was found to be important for accurately predicting the unsaturated hydraulic conductivity. (Cassar-FRC)
W81-01087

EFFECTS OF BICARBONATE ON SODIUM HAZARD OF IRRIGATION WATER: ALTERNATIVE FORMULATION,
Texas A and M Univ. Research Center, El Paso.
S. Miyamoto.
Soil Science Society of America Journal, Vol 44, No 5, p 1079-1084, September/October, 1980. 4 Tab, 21 Ref.

Descriptors: *Sodium, *Irrigation water, *Bicarbonates, *Drainage water, Effects, Sodium bicarbonate, Calcium, Magnesium, Equations, Saturation index.

An alternative formulation for predicting effects of bicarbonates on sodicity of irrigation waters, drainage water, and soils is presented. A comparison of results using this method with published data shows that the conventional equation using saturation index overestimates sodicity of water having a high ratio of calcium to bicarbonate and underestimates otherwise. If the pH of a drainage water is known, a second power polynomial approximation can be used to predict sodicity. Although the proposed methods are more complex than the conventional method, programmable calculators or minicomputers can be used satisfactorily. (Cassar-FRC)
W81-01089

SATURATED-UNSATURATED FLOW IN RADIAL DIRECTIONS GENERATED BY AN INJECTION WELL,
Princeton Univ., NJ. Dept. of Civil Engineering.
D. K. Babu.
Soil Science Society of America Journal, Vol 44, No 5, p 915-921, September/October, 1980. 6 Fig, 25 Ref.

Descriptors: *Injection wells, *Soil water movement, Saturated flow, Leaching, Infiltration, Equations.

The techniques and formulas derived in this paper can produce reliable estimates of flow quantities in solute transport and salt leaching phenomena. The saturated-unsaturated flow conditions are produced by a vertically-placed line source that injects water into the soil at a constant rate. Flow takes place only in horizontal radial directions. Singular perturbation methods are applied to derive a solution, uniformly valid at all points of time and space, as a power series in the perturbation parameter. Location of the wetting front and the transition face between saturated and unsaturated flow regimes may be determined by formulas. (Cassar-FRC)
W81-01091

COMPARISON OF ONE-STEP OUTFLOW LABORATORY METHOD TO AN IN SITU METHOD FOR MEASURING HYDRAULIC CONDUCTIVITY,
Wisconsin Univ., Madison. Dept. of Soil Science.
D. B. Jaynes, and E. J. Tyler.
Soil Science Society of America Journal, Vol 44, No 5, p 903-907, September/October, 1980. 4 Fig, 1 Tab, 33 Ref.

Descriptors: *Hydraulic conductivity, *Passioura method, *Soil water movement, Diffusivity, Unsaturated flow, Laboratory tests, Percolation.

The Passioura modification of the one-step outflow method for determining unsaturated hydraulic conductivity is compared with data obtained from the in situ crust method. Results, using three soils, agreed well. Discrepancies between hydraulic conductivity values obtained were attributed to hysteresis effects. With modifications, this inexpensive, rapid laboratory method can be used to measure hydraulic conductivity in constantly wet soils such as on-site liquid waste disposal systems. (Cassar-FRC)
W81-01092

2H. Lakes

LAKES OF OREGON: VOLUME 6. DOUGLAS COUNTY,
Geological Survey, Portland, OR. Water Resources Div.
J. F. Rinella.
Geological Survey Open-File Report, 1979. 123 p, 4 Fig, 2 Tab, 20 Ref.

Descriptors: *Lakes, *Oregon, *Investigations, *Hydrologic data, *Water quality, Drainage area, Elevation, Volume, Lake morphology, Lake morphometry, Thermal stratification, Inflow, Discharge(Water), Chemical analysis, Water utilization, Areal photography, Bathymetry, Mapping, *Douglas County lakes(OR).

An inventory of lakes and reservoirs in Oregon is useful in evaluating the surface-water supply of the State and in providing answers to questions about Oregon's lakes. Much of the information on lakes and reservoirs previously collected by Federal and State agencies has never been published. Those data were compiled and used as a basis for collecting additional information. This report provides information for use by city, county, and State planning groups in planning interpretative studies. The information also will be useful to sportsmen, tourists, and others interested in preserving the recreational value of Oregon's lakes. In addition to office compilation of existing data, each lake was visited. Most visits were made in summer or early fall when lakes were most accessible and when

water temperature and biological activity were near maximum. There are no commonly accepted criteria for distinguishing among lakes, ponds, pools, sloughs, and other water bodies. In general, any lake or impoundment with a surface area greater than 5 acres is included in this inventory, but a few smaller lakes are also included. Natural ephemeral lakes are not included nor are privately owned lakes or impoundments. (USGS)
W81-01043

A SALT BALANCE SIMULATION MODEL OF LAKE NASSER,
Academy of Scientific Research and Technology, Cairo (Egypt).
G. Guariso, D. Whittington, M. E. Abdel-Samie, and C. Kramer.
Water Supply and Management, Vol 4, No 112, p 73-80, 1980. 1 Fig, 3 Tab, 23 Ref.

Descriptors: *Lake Nasser, *Salinity, *Salt balance, *Irrigation water, *Artificial lakes, *Model studies, Reservoir, Lakes, Aswan High Dam, Nile River, Impounded waters, Discharge(Water), *Egypt.

Careful examinations of salt concentrations in Lake Nasser are necessary because salinization and water-logging presently exist throughout much of Egyptian agricultural land. A mass balance equation and a salt balance simulation model were used to calculate total dissolved solids in water discharged from the Aswan high dam for the years 1880-1976. Salinity trends and evaluation of the dam's impact cannot be predicted using data from a 10 to 15 year period. Rather, salinity is dependent on the pattern of water flowing into the Lake. Salinity is higher during years of high flood because evaporation losses are greater when the reservoir is full. Volumes of the lake water in any given month were calculated using inflow, seepage losses, evaporation losses and discharge from the dam. The salt balance simulation model was used to prepare a table listing water inflow and outflow, salt inflow and outflow, seepage and evaporation losses, total water volume as of July 31, and salt concentration for the years 1890-1919. (Cassar-FRC)
W81-01073

HYPOLIMNETIC METABOLISM IN THREE CAPE COD LAKES,
Connecticut Univ., Storrs. Biological Sciences Group.
P. H. Rich.
American Midland Naturalist, Vol 104, No 1, p 102-109, July, 1980. 1 Fig, 2 Tab, 15 Ref.

Descriptors: *Photosynthesis, *Hypolimnion, *Light penetration, *Oxidation, Stratification, Lakes, Oxygen, Respiration, Carbon, Eutrophication, Oligotrophy, Mesotrophy, Limnology, Oxidation-reduction potential, Water properties, *Cape Cod.

The oxidation potential of hypolimnetic organic matter and the carbon dioxide levels were determined in three closed-basin kettle lakes of similar morphometry on Cape Cod. Areal hypolimnetic measurements of O2 and dissolved inorganic carbon (DIC) were taken under stratified conditions in the summer of 1976. Lakes Gull and Hathaway showed O2 deficits characteristic of oligotrophic ponds, while Mares Pond was distinctly mesotrophic. DIC increments gave borderline eutrophic results for Mares Pond. Both O2 uptake and DIC release were observed to be inversely correlated to the amount of light penetrating to the hypolimnion. Ratios of DIC released to O2 taken up (by respiration) in the hypolimnia of the three lakes ranged from 1.4 to 3.4. This ratio was also directly correlated with the amount of light reaching the hypolimnion, suggesting that O2 uptake is suppressed more by underwater light than it is by DIC release. It was also hypothesized that lakes may increase their stock of alternate electron acceptors by contributing electrons to anaerobic photosynthesis at or below the depth of light compensation. (Geiger-FRC)
W81-01128

2I. Water In Plants

COMPARATIVE RESISTANCE OF THE SOIL AND THE PLANT TO WATER TRANSPORT,
Illinois Univ. at Urbana-Champaign. Dept. of Botany.
For primary bibliographic entry see Field 2G.
W81-01082

2J. Erosion and Sedimentation

SEDIMENT TRANSPORT OF STREAMS TRIBUTARY TO SAN FRANCISCO, SAN PABLO, AND SUISUN BAYS, CALIFORNIA, 1909-66,
Geological Survey, Menlo Park, CA. Water Resources Div.
G. Porterfield.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118622, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-64, August, 1980. 92 p, 19 Fig, 31 Tab, 33 Ref.

Descriptors: *Sediment transport, *Streamflow, *Bays, *California, Land use, Runoff, Sediment discharge, Sedimentation rates, Sediment load, Particle size, History, Water quality, Water resources development, Hydrologic data, San Francisco Bay(CA), San Pablo Bay(CA), Suisun Bay(CA).

A review of historical sedimentation data is presented, results of sediment-data collection for water years 1957-59 are summarized, and long-term sediment-discharge estimates from a preliminary report are updated. Comparison of results based on 3 years of data to those for the 10 water years, 1957-66, provides an indication of the adequacy of the data obtained during the short period to define the long-term relation between sediment transport and streamflow. During 1909-66, sediment was transported to the entire San Francisco Bay system at an average rate of 8.6 million cubic yards per year. The Sacramento and San Joaquin River basins provided about 83% of the sediment inflow to the system annually during 1957-66 and 86% during 1909-66. About 98% of this inflow was measured or estimated at sediment measuring sites. Measured sediment inflow directly to the bays comprised only about 40% of the total discharged by basins directly tributary to the bays. About 90% of the total sediment discharge to the delta and the bays in the San Francisco Bay system thus was determined on the basis of systematic measurements. (USGS)
W81-01034

SEDIMENT TRANSPORT IN THE SNAKE AND CLEARWATER RIVERS IN THE VICINITY OF LEWISTON, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
M. L. Jones, and H. R. Seitz.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $24.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-690 (WRI), August, 1980. 179 p, 23 Fig, 18 Tab, 18 Ref.

Descriptors: *Sediment transport, *Baseline studies, *Pre-impoundment, *Post-impoundment, *Idaho, Hydrologic data, Suspended load, Bed load, Streamflow, Channel morphology, Data collections, Sedimentation, *Snake River(ID), Clearwater River(ID).

During the period 1972-79, bedload in the Clearwater River in the vicinity of Lewiston, Idaho, ranged from about 50,000 tons per year in 1972 and 1974 to about 1,000 tons per year in the drought years of 1973 and 1977. Suspended-sediment load at the same location ranged from about 1,000,000 tons per year to about 50,000 tons per year for the same respective years. In the Snake River, bedload ranged from about 200,000 tons per year for 1972 and 1974 to about 10,000 tons per year in 1973; bedload was too minimal for determination in 1977. Suspended-sediment load ranged from about 5,000,000 tons per year in 1974 to about 50,000 tons in 1977. Bedload thus ranged from about 2 to 10% of suspended load and averaged about 5%. For either river, bedload particle size was bimodal. Modes were in the medium- to course-sand range and in the very coarse-gravel range. Suspended-sediment particle size was generally finer than sand. Thus, particles constituting bedload were distinctively larger in size than particles constituting suspended load. (USGS)
W81-01037

KINETICS OF TRACE METAL PARTITIONING IN MODEL ANOXIC MARINE SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W81-01154

2K. Chemical Processes

GEOCHEMISTRY OF WATER IN THE FORT UNION FORMATION OF THE NORTHERN POWDER RIVER BASIN, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-01041

THE MONOSACCHARIDE SPECTRA OF NATURAL WATERS,
Delaware Univ., Lewes. Marine Studies Complex.
K. Mopper, R. Dawson, G. Liebezeit, and V. Ittekkot.
Marine Chemistry, Vol 10, No 1, p 55-66, October, 1980. 4 Fig, 2 Tab, 32 Ref.

Descriptors: *Carbohydrates, *Sampling, *Natural streams, Chromatography, Separation techniques, Sea water, Groundwater, Estuaries, Laboratory tests, Desalination, Chemical reactions, Carbon cycle, Photosynthesis, Aquatic environments.

A variety of water and sediment pore water samples from a wide range of environments were collected and analyzed for monosaccharides by liquid chromatography. Twelve sugars were positively identified from desalted extracts of the water samples. The dominant monosaccharides in all samples were glucose and fructose. Over 150 seawater and sediment pore water samples had levels of fructose which were highly correlated with their levels of glucose. The epimerization reaction of glucose to fructose was examined in laboratory kinetic tests using sterilized samples of natural seawater kept in the dark. The forward rate constant was determined at 2 and 25 degrees, as was the time required for each system to attain equilibrium. The actual ratio of fructose to glucose in natural water samples was found to be independent of the total monosaccharide levels, and was usually in the range of 1.0-1.4/1. Factors which may have been responsible for the discrepancy in the predicted and observed ratios such as biological sources of fructose, preferential utilization of glucose or fructose, and preferential formation of fructose-transition metal ion associations were considered. (Geiger-FRC)
W81-01053

IN-SITU REGISTRATION OF OXYGEN UTILIZATION AT SEDIMENT-WATER INTERFACES,
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
H. P. Hansen, K. Grasshoff, and J. Petersen.
Marine Chemistry, Vol 10, No 1, p 47-54, October, 1980. 6 Fig, 7 Ref.

Descriptors: *Sediment-water interfaces, *Oxygen demand, *Measurement, Equipment, Sands, Mud, Water temperature, Water pressure, Kiel Bight.

Oxygen utilization of the sediments in the Kiel Bight was measured using a polyacrylic dome anchored over natural sediments. Vertical convection was produced by means of a small pump, and

oxygen partial pressure and temperature were measured at 20 minute intervals by an automatic data system. After recovery, the data stored in digitized form on magnetic tape was read by a microprocessor, interpreted, listed, and plotted against time. Sandy sediments showed a decrease in oxygen saturation which was nearly independent of temperature. Muddy sediments at low temperatures showed a similarly slow decrease, but a considerably increased oxygen utilization with increasing temperatures. Sediment type and temperature were the dominating control parameters for relative oxygen utilization, and the absolute oxygen consumption of a given sediment type at a given temperature was linear function of oxygen concentration. (Small-FRC)
W81-01054

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF NOVEL POROUS SUBSTRATES FOR ULTRAFILTRATION, DESALINATION, AND WATER RECLAMATION,
Gulf South Research Inst., New Orleans, LA. Dept. of Polymer.
I. Cabasso.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-147787, Price codes: A05 in paper copy, A01 in microfiche. Final Report submitted to Office of Water Research and Technology, January 31, 1980. 95 p, 60 Fig, 11 Tab. OWRT-C-B0294-S(No 8521)(1), 14-34-0001-8521(1).

Descriptors: *Membranes, *Reverse osmosis, *Polymers, *Water reuse, *Testing procedures, Porous substrates, Filtration, Reclaimed water, Desalination, Poly(dimethyl phenylene oxide), Ultrafiltration, Composite membranes.

Poly(phenylene oxide) (PPO) polymers were successfully cast into an anisotropic porous substrate, which may be utilized in water reclamation (by ultrafiltration and composite membranes). High hydraulic permeabilities and good mechanical stability are characteristic of these macrovoid-free membranes. The membranes are cast in a continuous fashion to exhibit hydrophobic (or hydrophilic) properties. P-amino-naphthalene sulfonic acid was applied from aqueous solution to chemically interact and produce an ionic, charged surface. Thus, low molecular weight (approximately 250 MW) organo-ionic solutes can be efficiently removed in a low pressure ultrafiltration process. Membrane productivity in this operational mode is very high (50-200 gfd in pressure ranges of 20-100 psi). As such, low molecular weight surfactant separation is possible, and consequently, the purification of water by removal of low molecular weight, neutral, organic contaminants, which are trapped in the transient micelle formation at the membrane-solute interface, is very efficient. The substrate displays a crystalline 'coral' morphology which has the endurance required from the support component of a reverse osmosis membrane. This, combined with the superb chemical stability of the membrane, allows deposition of a permaselective, ultrathin membrane from solvent systems which would dissolve a conventional polysulfone support (e.g., acetone, DMF, DMA). As such, cellulose acetate and cellulose triacetate were deposited on an MPPO support from acetone/dioxane solution. Also, quaternary polymers were deposited onto a sulfonated (sulfonic acid) surface to form a permaselective skin consisting of polyelectrolyte layers.
W81-01001

DESALINATION/POWER CYCLES WITH THE BIPHASE ROTARY SEPARATOR AND TURBINE,
Biphase Energy Systems, Santa Monica, CA.
P. L. Limburg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150237, Price codes: A05 in paper copy, A01 in microfiche. Final Report prepared for Office of Water Research and Technology, September, 1980. 83 p, 46 Fig, 13 Tab, 11 Ref. OWRT-G90028-D(No 9407)(1), 14-34-0001-9407.

Descriptors: *Desalination, *Desalination process, *Equipment, *Turbines, *Separation techniques, *Separators, Sea water, Flash distillation, Design, *Reverse osmosis, Multiple-effect distillation, Vapor compression, Energy recovery, Costs, Biphase turbine, Rotary Separator, Power production, Cycle studies, Thermal power plants, Waste heat.

The Biphase Rotary Separator Turbine (RST) generates fresh water and power when using salt water as a working fluid. Cycle studies of single- and two-stage RST cycles determined water-production rates to be 0.6 to 1.8 pounds per thousand Btus of heat input and net power-production efficiencies of 2 to 10%, depending on cycle configuration and the maximum saltwater temperature. The Biphase RST can be beneficially integrated with conventional desalination processes. Cycles studied include a topping cycle for distillation plants, shaft-power-source cycle for reverse osmosis and vapor-compression plants, and a reverse-osmosis cycle recovering the reject-brine pressure energy. Short duration tests of a Biphase RST showed that fresh water production (30 ppm TDS) from seawater is feasible. Conceptual design studies were made of a single-stage desalination/power system suitable for a first demonstration plant. The system produces 9000 gallons per day and 90 horsepower from the exhaust-gas energy of a 2125 horsepower diesel engine.
W81-01165

RESEARCH AND DEVELOPMENT ON A SPIRAL-WOUND MEMBRANE SYSTEM FOR SINGLE-STAGE SEAWATER DESALINATION,
UOP, Inc., San Diego, CA. Fluid Systems Div.
R. L. Riley, G. R. Hightower, C. R. Lyons, C. E. Milstead, and M. W. Seroy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-151953, Price codes: A08 in paper copy, A01 in microfiche. Final Report prepared for Office of Water Research and Technology, March, 1975. 130 p, 59 Fig, 29 Tab, 12 Ref. OWRT (No 3191)(1), 14-30-3191.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Membranes, Membrane processes, Sea water, Thin-film composite membranes, Spiral elements, Membrane types.

Research and development work under this contract covered the period January 1, 1973 through December 31, 1974. Four distinct types of thin-film composite reverse osmosis membranes were developed and scaled up for incorporation into spiral wound elements. The first membrane had cellulose triacetate formed directly on a porous cellulose nitrate-cellulose acetate support. The second membrane, a polyurea thin film composite (designated as NS-100) was formed by an in-situ interfacial polymerization on a fabric reinforced polysulfone support. Both of these membranes demonstrated salt rejections greater than 99.5% from a 35,000 ppm sodium chloride feed; product water fluxes were in the range of 12 to 17 gal/ft sup 2-day. The third membrane was a polyamide type referred to as PA-100. The fourth and last membrane investigated consisted of a poly (ether/amide) formulation and was designated PA-300. Laboratory tests with the PA-100 and PA-300 membranes showed water fluxes in excess of 23 gal/ft sup 2-day and salt rejection efficiencies greater than 99.3% desalting simulated seawater at 1000 psi. A major part of the program was the development of spiral wound elements from each of these membrane types. Elements were prepared using various methods of construction and adhesives to improve element reliability and minimize flux decline. Field evaluation testing with cellulose triacetate composite membrane elements were conducted at the Sea World Marine Park in San Diego, California. Testing was prematurely terminated after 3200 hours because of problems with excessive membrane fouling.
W81-01166

RESEARCH AND DEVELOPMENT ON A SPIRAL-WOUND MEMBRANE SYSTEM FOR SINGLE-STAGE SEAWATER DESLINATION,
UOP, Inc., San Diego, CA. Fluid Systems Div.
R. L. Riley, C. R. Lyons, C. E. Milstead, M. W. Seroy, and M. Tagami.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-151938, Price codes: A08 in paper copy, A01 in microfiche. Final Report prepared for Office of Water Research and Technology, March 1, 1976. 144 p, 21 Fig, 49 Tab, 7 Ref. OWRT (No 3303)(1), 14-30-3303(1).

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Membranes, Membrane processes, Seawater, Brackish water, Thin-film composite membranes, Spiral elements, Membrane production, Pilot plant.

Work under this contract covered the period January 1, 1975 through December 31, 1975. Emphasis was placed on developing a thin-film composite spiral reverse osmosis membrane system to desalt seawater in a single stage at a maximum pressure of 1,000 psi. Two thin film composite membrane types were developed concurrently to achieve this objective. The first membrane was a cellulose triacetate thin-film on a porous cellulose nitrate - cellulose acetate support. The second membrane was a poly (ether/amide) designated PA-300 cast on a porous polysulfone. A major objective of this program was the design, construction and operation of a fabrication assembly for production of 14-inch wide PA-300 membrane. This machine produced membranes continuously in lengths up to 550 ft. that yielded water fluxes over 20 gals/ft sup 2-day and salt rejections greater than 99.5% while desalting a 35,000 ppm sodium chloride feed at 1000 psi. Extensive field evaluation tests with both 2-inch and 4-inch diameter spiral module elements were conducted on seawater at Sea World, San Diego, California and the OWRT Sea Water Test Facility at Wrightsville Beach, North Carolina. In addition, brackish water desalination studies were undertaken with the PA-300 membrane at the OWRT Brackish Water Test Facility, Roswell, New Mexico. Other areas of research included characterization of PA-300 membrane system properties with regard to wet-dry cycling, chlorine stability and rejection of organic compounds. Additional studies included further optimization of the fabric reinforced poly-sulfane support.
W81-01167

3B. Water Yield Improvement

THE USE OF THE COMPARTMENTED RESERVOIR IN WATER HARVESTING AGRISYSTEMS,
Arizona Water Resources Research Center, Tucson.
B. C. Cluff.
In: Arid Land Plant Resources, Proceedings of the International Arid Lands Conference on Plant Resources, October 8-15, 1978, International Center for Arid and Semiarid Land Studies, Texas Tech. Univ. Lubbock, p 482-500, July, 1979. 5 Fig, 37 Ref. OWRT-B-015-ARIZ(3), 14-01-0001-1425.

Descriptors: *Water harvesting, *Rain water, *Rainfall-runoff relationships, Runoff, *Water conservation, Reservoir evaporation control, *Reservoir storage, Arid lands, Water yield improvement, Water loss, Reservoir design, Surface waters, Water storage, Storage capacity, Computer models, Arizona.

Water harvesting agrisystems or the coupling of artificially collected rain water with agriculture and a surface storage system, offer a promising way of increasing both the quantity and dependability of water in arid and semiarid lands. The use of a compartmented reservoir in conjunction with these agrisystems provides a relatively low-cost efficient method of storage as compared with conventional storage methods. Based on the principle that the division of a conventional reservoir into

compartments with the systematic pumping or transfer of water between compartments can achieve evaporation control through reduction of surface area, these reservoirs are demonstrated here to easily obtain efficiencies in excess of 50-60% where conventional reservoirs of the same depth covering the same area were unable to sustain their own evaporation loss. A computer model has been developed (Crop-76) to study the parameters involved in this compartmented system and their relationship to each other using historical data. This model is briefly described and illustrated through its use in the design of a 16 ha Jojoba water harvesting agrisystem on retired farmland in the Avra Valley 32 km west of Tucson, Arizona. (Tickes-Arizona)
W81-01022

3C. Use Of Water Of Impaired Quality

APPLICATION OF SEWAGE EFFLUENT TO COLUMNS OF A MOUNTAIN MEADOW SOIL: I. ERRORS IN CALCULATING THE TRANSPORT OF IONIC SALTS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
K. A. Barbarick, A. Klute, and B. R. Sabey.
Soil Science Society of America Journal, Vol 44, No 5, p 921-924, September/October, 1980. 1 Fig, 3 Tab, 12 Ref.

Descriptors: *Sewage effluents, *Irrigation, *Soil-plant-water relationships, *Municipal wastes, Ion transport, Hayden(CO), Sewage disposal, Salts, Liquid wastes, Environmental effects.

The effects of applying municipal sewage effluent from Hayden, Colorado, on a mountain meadow soil were studied by irrigating soil-packed columns with the effluent for 12 weeks. Some columns were destructively sampled at intervals to determine bulk density and gravimetric moisture content. Five other columns contained porous cups at 7 depths for sampling the extracts. After the steady-state flow had been reached, transport of ionic salts was calculated. An error analysis showed that electrical conductivity measurements in the soil extracts collected in the porous cups would have to be determined to the nearest 0.003 mmho per cm to reduce the calculated flux error to 10% at a 70 cm depth. Error in the fluxes increased with depth. (Cassar-FRC)
W81-01090

IRRIGATION OF INTENSIVELY CULTURED PLANTATIONS WITH PAPER MILL EFFLUENT,
North Central Forest Experiment Station, Rhinelander, WI.
E. A. Hansen, D. H. Dawson, and D. N. Tolsted.
Tappi, Vol 63, No 11, p 139-143, November, 1980. 5 Fig, 2 Tab, 13 Ref.

Descriptors: *Soil-plant water relationships, *Pulp wastes, *Irrigation, *Forest management, Application methods, Industrial wastes, Waste water disposal, Effluents, Disposal, Planting management, Pulp and paper industry, Water pollution.

Use of paper mill effluent to irrigate short-rotation, intensively cultivated plantations of Populus and Salix produced good growth of trees during the 3 years since planting in 1977. Total effluent applied at an average rate of 11 inches per week during the June to September growing season was 11.7 feet in 1977, 10.0 feet in 1978, and 36 feet in 1979. Populus growth averaged 3 feet per year during the first 2 years and 6 to 7 feet the third year. The Mead Corporation mill's output of 32 mgd applied at the rate of 11 inches per week to 750 acres produced 2,600 tons of fiber per year. Concentrations of Na, Cl, and SO4 in groundwater increased greatly, from pretreatment levels of 1, 1, and 4 ppm to 300, 400, and 190 ppm respectively after treatment. K, Ca, Mg, and N increased to a lesser extent. P, Mn, and Al did not change significantly. In order to reduce groundwater pollution, disposal sites should be near rivers or other natural drains. The secondary-treated effluent reaching the groundwater table was of better quality than the tertiary treated effluent normally discharged by the mill into a nearby river. (Cassar-FRC)
W81-01094

EFFECT OF THE SALINITY OF IRRIGATION WATER ON WHEAT YIELD AND SOIL PROPERTIES,
Raja Balwant Singh Coll., Agra (India). Dept. of Agricultural Chemistry.
B. Singh, and P. Narain.
Indian Journal of Agricultural Science, Vol 50, No 5, p 422-427, May, 1980. 3 Fig, 4 Tab, 7 Ref.

Descriptors: *Irrigation water, *Salinity, *Wheat, *Crop response, *Sodium chloride, Adsorption, India, Leaching, Cations, Hydraulic conductivity.

Experiments conducted in the same field during 1972-73 and 1973-74 indicated that wheat could tolerate irrigation with water having a salinity up to 8 mmhos per cm conductivity. When waters with 1.5 and 2 times this conductivity were used, grain yield decreased by 29 and 69% respectively the first season, and 74 and 89% respectively the second season. Wheat was irrigated 4 times in 1972-73 and 5 times in 1973-74. Pearl millet was grown as rotation crop and required 1 irrigation in 1973 and 3 in 1974. Salinity accumulated at a depth of 0 to 60 cm when water having a conductivity of more than 4 mmhos per cm was used, despite leaching by monsoon waters. The sodium adsorption ratio of the irrigation water and of the soil up to a depth of 30 cm increased. Hydraulic conductivity of soil decreased as salinity of irrigation water increased. (Cassar-FRC)
W81-01114

USING SALINE WATER FOR CROP PRODUCTION IN NEW MEXICO,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
G. A. O'Connor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-148058, Price codes: A03 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, New Mexico State University Technical Completion Report No 127, December, 1980. 26 p, 2 Fig, 5 Tab, 9 Ref, Append. OWRT-A-061-NMEX(1), 14-34-0001-0133.

Descriptors: Salinity, Water management, Groundwater, *Supplemental irrigation, *Salt tolerance, Sorghum, *Crop response, *Impaired water use, Saline water, Irrigation water, *New Mexico, Greenhouse studies.

New Mexico has vast supplies of saline groundwaters whose use could expand irrigated agriculture and conserve good quality water for domestic use. Unfortunately, little is known of the long-term effects of such waters on soils and crops common to New Mexico. Thus, two studies were conducted to determine the feasibility of using various salinity waters (total dissolved solids 1,250-15,000 mg/l). Greenhouse data suggest that the most realistic way to utilize saline waters is as supplements to normal fresh water irrigations. The degree of supplementation possible without severe yield reductions varies inversely with water salinity. However, very saline waters (10,000 and 15,000 mg/l TDS) are not likely to be of practical use for common agricultural crops at any degree of supplementation. Using saline water as the sole source of irrigation water is reasonable for long-term cultivation of common crops only with the lowest salinity water (1,250 mg/l TDS). One season emergencies may be met with waters as saline as 2,500-5,000 mg/l TDS, but continued use will severely reduce yields.
W81-01156

3D. Conservation In Domestic and Municipal Use

ANTICIPATE PIPE FREEZE-UPS,
B. Block.
Water and Wastes Engineering, Vol 17, No 10, p 34-35, October, 1980. 2 Fig.

Descriptors: *Distribution systems, *Freezing, *Temperature control, Equipment, Kansas, Pipes, Potable water, Frost, Measurement, Instrumentation, Ice.

Since winters are very cold in Idaho, the city of Ketchum installed freeze-prevention devices in its new 85,000 ft pipe sewage system to detect frost penetration and reduce the possibility of damage to the system and the wasting of water. The device consists of a temperature probe inserted into a one inch polyvinyl chloride conduit near the pipeline. The pipe has connecting thermistor leads which are adjoined along with the probe to a junction box situated on a utility pole. Each temperature probe is checked on a regular basis by a hand-held temperature meter. Eight temperature probes were installed at dead spots in the water system, and selected hydrants were used throughout the system for water wasting. Construction of the new sewer system took only one summer. Ketchum residents were concerned about freezing in the pipes because many of the residential areas had private wells and were not required to hook up to the municipal supply. Also, a number of the hook-ups were to resort structures that could not guarantee a steady flow demand. After the new system weathered one winter, a dead end section without the frost detection device did freeze up, but the following spring no sign of pipe damage was reported, and the pipe layout in this section was altered to correct the problem. (Geiger-FRC)
W81-01075

3F. Conservation In Agriculture

THE USE OF THE COMPARTMENTED RESERVOIR IN WATER HARVESTING AGRISYSTEMS,
Arizona Water Resources Research Center, Tucson.
For primary bibliographic entry see Field 3B.
W81-01022

WHAT TO DO WHEN THE WELL RUNS DRY,
J. Walsh.
Science, Vol 210, No 4471, p 754-756, November, 1980.

Descriptors: *Aquifers, *Irrigation systems, *Kansas, Corn, Grain sorghum, Irrigation permits, Groundwater, Agriculture, Cattle, Costs, Water management, Water shortage, Pumping, Great Plains, Water table.

Reductions in supplies of irrigation water in Western Kansas in the summer of 1980 caused drastic decreases in corn crop yields. Grain crops were successfully grown in this region in previous years with heavy irrigation from the Ogallala aquifer. Estimates have shown that the underground water of this area may be depleted in 3 to 20 years, which will cause problems not only in the field of agriculture, but to the beef cattle industry as well. Since corn is most sensitive to drought during the pollination stage, research may aid in shortening the irrigation period to only the most effective segments of crop growth. Alternate crops requiring less irrigation such as grain sorghum are also being cultivated in place of corn. Careful management plans must be executed and cooperation between farmers and government researchers instated to stall the impending depletion of irrigation water supplies. Plans have been considered to set up pumping systems to obtain water from the Missouri River and the Dakota aquifer (an aquifer of the area much further underground) to supplement the water pumped from the Ogallala. The government will also allow owners of aquifer rights to claim depletion allowances to boost farm economies, increase land values, and aid the transition from irrigation farming. (Geiger-FRC)
W81-01060

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

SEEPAGE STUDY OF THE WEST SIDE AND WEST CANALS, BOX ELDER COUNTY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
R. W. Cruff.
Utah Department of Natural Resources Technical Publication No 67, 1980. 38 p, 3 Fig, 2 Tab, 1 Ref.

Descriptors: *Canal seepage, *Utah, *Hydrologic data, *Water resources, *Flow nets, Measurement, Water levels, Discharge(Water), Water temperature, Specific conductance, Evaluation, *Box Elder County(UT), *West Side Canal(UT), West Canal(UT).

A study of the gains or losses of the West Side and West Canals from Cutler Reservoir to near Penrose, Box Elder County, Utah, was made to aid in water allocation for the canal system. Four sets of seepage measurements made in 1978 were used in the analysis. Adjustments for fluctuations in flow in the canals were made from information obtained from water-stage recorders operated at selected locations along the canals during the time of each seepage run. The study showed no detectable gain or loss for the West Side Canal and a net loss of 50 cubic feet per second for the West Canal. During the seepage runs, an average of 365 cubic feet per second entered the West Canal, thus the net loss was 13.7% of the available water. About 40% of this loss occurred within about 5% of the length studied on the West Canal.
W81-01026

WATER-RESOURCES RECONNAISSANCE OF THE SOUTHEASTERN PART OF ST. PAUL ISLAND, PRIBILOF ISLANDS, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
A. J. Feulner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226962, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-61, 1980. 12 p, 3 Fig, 2 Tab, 3 Ref.

Descriptors: *Water resources, *Surveys, *Alaska, *Surface waters, *Groundwater resources, Water quality, Water supply, Available water, Aquifer characteristics, Islands, Lakes, Potable water, Salinity, Fish handling facilities, Baseline studies, *St Paul Island(AK).

A hydrologic reconnaissance of the southeastern part of St. Paul Island, Pribilof Islands, Alaska, was made in August 1979 to determine if sufficient freshwater is available for a proposed harbor and fish-processing facility. Only three wells were being used in 1979, two by the community of St. Paul and one by the Coast Guard Loran facility. All wells are in the southeastern part of the island. The island has no established surface drainage, and no springs were found on the eastern part of the island during the survey. Drainage of groundwater from the island is assumed to be by seepage through the sandy deposits along the east coast and possibly by undersea discharge elsewhere on the island. On the basis of present well yields, amount of freshwater inferred to be present below the water table, and potential recharge from precipitation, it is concluded that it should be possible to design a well field in the southeastern part of the island that could yield more than a million gallons per day without danger of inducing saline water into the well field. The water is of good chemical quality. (USGS)
W81-01033

DESIGNING IRRIGATION-CUM-DRAINAGE PONDS FOR ALKALI LANDS,
Central Soil Salinity Research Inst., Karnal (India).
S. K. Gupta, and R. N. Pandey.
Indian Journal of Agricultural Science, Vol 50, No 5, p 428-430, May, 1980. 1 Fig, 2 Tab, 2 Ref.

Descriptors: *Runoff, *Agricultural runoff, Rainfall disposition, *Alkali soils, *Drainage engineering, *Farm ponds, Rice, Storm runoff, Infiltration, Ponds, Surface drainage, Rainfall-runoff relationships, India.

A water balance equation in which the amount of runoff is calculated from precipitation, evaporation, infiltration, depth of detention in crop fields, and duration of storm was used to design a dug-out pond to store storm drainage from rice-planted alkali lands. Although theoretical calculations suggested a 28.2 hectare-cm pond to drain a 6 hectare rice field, actual capacity was measured at 22 hectare-cm. Observed and predicted runoff data agreed closely. A pond capacity satisfactory for this region may be calculated, considering a storm of 2 days with a 10 year return period. Water stored in the ponds may be utilized for other purposes, thus producing additional capacity for storm runoff. As infiltration rates improve with land treatments, more storage is possible. (Cassar-FRC)
W81-01113

4B. Groundwater Management

GROUND-WATER APPRAISAL OF THE FISHKILL-BEACON AREA, DUTCHESS COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-01028

SIMULATED WATER-LEVEL DECLINES NEAR MARIENTHAL, WEST-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
L. E. Dunlap.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-105272, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-39, April, 1980. 15 p, 7 Fig, 5 Ref.

Descriptors: *Groundwater, *Aquifers, *Model studies, *Water table, *Kansas, Hydrogeology, Water levels, Irrigations, Pumping, Withdrawal, Mathematical models, Drawdown, Overdraft, Simulation analysis, Projections, Water management(Applied), Hydrographs, West-central Kansas, *Wichita County(KS).

Intensive study in an area of 12-square miles in northeastern Wichita County, Kansas, has shown a decrease of 30 to 50% in saturated thickness of the Ogallala Formation since the development of irrigation. Projections from a digital model indicated the additional water-level declines that might occur from 1978 to 1989 if the pumpage in the model area was assumed to be one-half, equal to, or double the 1977 rate. The additional declines would range from 5 to 15 feet, 15 to 30 feet, and 25 to 40 feet, respectively. If pumpage only in the intensive-study area were assumed to be one-half or double the 1977 rate, water-level declines would range from 10 to 20 feet and from 20 to 25 feet, respectively. Reducing pumpage only in the intensive-study area could reduce the water-level declines locally. However, declines would be greatest near the edge of the area as a result of continued pumpage by wells outside the area. The digital model was more sensitive to changes in pumpage than to changes in hydraulic conductivity, specific yield, or recharge.
W81-01030

GEOLOGIC ASPECTS OF THE SURFICIAL AQUIFER IN THE UPPER EAST COAST PLANNING AREA, SOUTHEAST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. L. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.50 in paper copy, $1.00 in microfiche. Geological Survey Open-File Report 80-586 (WRI), 1980. 2 Sheets, 9 Ref.

Descriptors: *Water management(Applied), *Geology, *Aquifers, *Groundwater, *Florida, Water utilization, Aquifer characteristics, Hydrogeology, Sediments, Planning, Maps, Contours, Cross-sections, *Southeast Florida, St. Lucie County(FL), Martin County(FL), Okeechobee County(FL).

The Upper East Coast Planning Area, as designated by the South Florida Water Management District, consists of St. Lucie County, Martin County, and eastern Okeechobee County. The surficial aquifer is the main source of freshwater for agricultural and urban uses in the area. The geologic framework of the aquifer is displayed by contour mapping and lithologic cross sections to provide water managers with a better understanding of the natural restraints that may be imposed on future development. The surficial aquifer is primarily sand, limestone, shell, silt, and clay deposited during the Pleistocene and Pliocene Epochs. The aquifer is unconfined and under water-table conditions in most of the area, but locally, artesian conditions exits where discontinuous clay layers act as confining units. Impermeable and semipermeable clays and marls of the Tamiami (lower Pliocene) and Hawthorn Formations (Miocene) unconformably underlie the surficial aquifer and form its base. Contour lines showing the altitude of the base of the aquifer indicate extensive erosion of the Miocene sediments prior to deposition of the aquifer materials. (USGS)
W81-01038

AN ECONOMIC EVALUATION OF THE FEASIBILITY OF ARTIFICIAL GROUNDWATER RECHARGE IN NEBRASKA,
Nebraska Univ.-Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W81-01155

DIGITAL-SIMULATION AND PROJECTION OF HEAD CHANGES IN THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM, COASTAL PLAIN, NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-01185

SIMULATED EFFECTS OF A PROPOSED WELL FIELD ON THE GROUNDWATER SYSTEM IN THE SALT RIVER INDIAN RESERVATION, MARICOPA COUNTY, ARIZONA,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-01191

MAPS SHOWING SATURATED THICKNESS, JANUARY 1979, AND PERCENTAGE DECREASE IN SATURATED THICKNESS, 1950-79, OF UNCONSOLIDATED AQUIFER, WEST-CENTRAL, KANSAS,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-01195

4C. Effects On Water Of Man's Non-Water Activities

MANUAL OF PRACTICE ON URBAN DRAINAGE.
Environmental Protection Service, Ottawa (Ontario). Water Training and Technology Transfer Div.
For primary bibliographic entry see Field 10D.
W81-01021

MODELING THE RUNOFF PROCESS IN URBAN AREAS,
Purdue Univ., Lafayette. School of Civil Engineering.
For primary bibliographic entry see Field 2A.
W81-01153

4D. Watershed Protection

COSTS AND BENEFITS OF TERRACES FOR EROSION CONTROL,
Illinois Univ., Urbana-Champaign. Dept. of Agricultural Engineering.
J. K. Mitchell, J. C. Brach, and E. R. Swanson.
Journal of Soil and Water Conservation, Vol 35, No 5, p 233-236, September/October, 1980. 6 Fig, 3 Tab, 9 Ref.

Descriptors: *Erosion control, *Terracing, *Cost-benefit analysis, Feasibility studies, Farm management, Watershed management.

Terrace construction costs were estimated using 1978 data to determine whether terrace systems were economically justifiable to control erosion. Field slopes between 1 and 15% using both the gradient and the tile-outlet-storage type of terrace were considered. All cost and yield considerations were spaced over a 20 yr period. It was determined that six factors affected the cost of the terracing system over the 20 yr: kind of subsoil, slope, type of terrace used, level of management, and soil erodibility. The cost of constructing terraces does not increase at a constant rate with increasing slope. A sharp reversal in the cost curve occurs at a slope of 6% because calculations for slopes of 6% or greater are based on the use of grass backslope terraces, thus reducing the effective field slope, allowing the terraces to be spaced farther apart. For any initial level of productivity, terrace systems are more costly for soils on favorable subsoils than for those on unfavorable subsoils. The highest net benefits are realized on slopes from 4 to 10% because the increases in losses due to erosion tend to cancel out the increased construction costs. The costs of tile-outlet terraces at various levels of initial productivity were about $130 more per acre than for gradient terraces at the end of the 20 yr. The study indicated that the only situation in which terracing increased farm income was when a gradient terrace system was used on highly erodible soils with unfavorable subsoils and at a high level of management. (Baker-FRC)
W81-01062

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY OF COPPER(II) AT THE GLASSY CARBON ELECTRODE,
New Hampshire Univ., Durham. Dept. of Chemistry.
R. B. Smart, and J. H. Weber.
Analytica Chimica Acta, Vol 115, p 331-336, 1980. 3 Fig, 1 Tab, 18 Ref. OWRT-B-004-NH(4).

Descriptors: *Analytical techniques, *Copper, *Fulvic acids, *Assay, *Chemical analysis, *Water pollution, Contamination(Water), Metals, Organic acids, Organic compounds, Polarographic analysis, Analysis, Pollution(Water), Research and development, Estimating, Evaluation, Testing procedures, Measurement, Calibrations, Electrodes, Instrumentation, Monitoring, Testing, Pollutants, Glassy carbon electrode.

The ultimate goal of this study was to use the glassy carbon electrode (GCE) for measurements of metal-complex conditional stability constants, and thus the effect of pH on the GCE response was examined. Also the use of the title technique (DPASV) for copper (II) in potassium nitrate solution was tested to try to utilize lower plating times, yet maintain or improve the limit of detection of the linear scan technique. Detection limits were determined at different pH values, and the usual instrumental parameters were optimized. The DPASV of copper (II) at the GCE gave detection limits similar to those for the rotated GCE, but with much shorter plating times, offering the advantage of decreased analysis time. The GCE had been studied earlier for possible use in monitoring copper (II) ions in a complexiметric titration of naturally-occurring organics in water since the GCE does not adsorb soil fulvic acids, but the two distinct linear regions for the copper (II) calibration curves at pH 4.5 and 6.5 would make it difficult to locate endpoints in such titrations. Also, deviations from linearity at higher copper (II) concentrations suggested that the GCE be used very carefully in these titrations. (Zielinski-IPA)
W81-01010

ASBESTOS FIBRES IN RECEIVING WATERS,
Department of the Environment, Vancouver (British Columbia). Pacific Region.
H. Schreier, and J. Taylor.
Technical Bulletin No 117, 1980. 18 p, 7 Fig, 9 Tab, 63 Ref, 1 Append.

Descriptors: *Asbestos fibres, *Water supply, *Drainage systems, *Toxicity, Hydrologic cycle, Concentrations, Distributions, British Columbia, Water analysis, Water pollution, Asbestos, Evaluation, Public health, Hazards.

Little is known about asbestos fibre concentration in water supplies and drainage systems and the possible health hazard which it could create. A comprehensive review of the subject is provided in this report, which includes results of exploratory studies in British Columbia and the Yukon, and a comparison with concentrations elsewhere in North America. Asbestos fibres, which can be introduced into the hydrologic system by natural and man-made processes, were reported in all phases of the hydrologic cycle. The greatest source appears to be natural exposures of asbestos-bearing bed rock where the fibres are introduced by surface runoff as well as by groundwater drainage. Levels of up to 10 billion fibres/L were measured in natural river systems in British Columbia; these results were significantly higher than those reported for drinking water supplies in eastern Canada and the eastern United States. The concentrations are comparable with those reported from mine effluents in Quebec and groundwater levels in New Mexico. Weathering processes and the abundance of asbestos-bearing metamorphic rocks in British Columbia are thought to be the main causes of these high concentrations. It is suggested that bedrock geology be used as a means of predicting high asbestos concentrations in drainage systems. Finally, for a better understanding of the processes responsible for the asbestos fibre distribution in water systems, it is suggested that an investigation of the transport mechanisms be initiated and that the spatial and seasonal variation in a number of drainage systems be determined. (WATDOC)
W81-01013

INTERLABORATORY QUALITY CONTROL STUDY NO. 24, ANALYSIS OF EIGHT ACID HERBICIDES IN NATURAL FRESH WATER,
Canada Center for Inland Waters, Burlington (Ontario).
H. Agemian, and A. S. Y. Chau.
Report Series No 67, 1980. 9 p, 4 Fig, 5 Tab, 8 Ref.

Descriptors: *Acid herbicides, *Freshwater, *Pesticide residues, Canadian laboratories, Quality control study, Water quality, Methodology, Standards, Herbicides, Acids, *Laboratory tests, *Analytical techniques, *Canada, Evaluation.

A national interlaboratory quality control study for Canadian laboratories on the determination of eight acid herbicides (MCPA; 2,4-DP; 2,4-D; silvex; MCPB; 2,4,5-T; 2,4-DB; and picloram) in natural fresh water is described. The data show that most laboratories have acceptable expertise for the analysis of silvex; 2,4,5-T; and 2,4-D. No data were reported for MCPB by any laboratory, while only a few participants reported results on MCPA; 2,4-DP; 2,3-DB; and picloram. The overall results indicate that most participants in this study had not attempted the analysis of all eight herbicides. This may reflect the limited expertise in multi-residue analysis of these herbicides in water at the designed concentrations. (WATDOC)
W81-01016

WATER QUALITY OF BEAR CREEK BASIN, JACKSON COUNTY, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
L. A. Wittenberg, and S. W. McKenzie.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $16.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-158 (WRI), 1980. 118 p, 26 Fig, 1 Plate, 24 Tab, 56 Ref.

Descriptors: *Water quality, *Oregon, *Irrigation canals, *Surface waters, *Streamflow, Return flow, Irrigation water, Water reuse, Water pollution sources, Sediments, Chemical analysis, Bacteria, Biochemical oxygen demand, Dissolved oxygen, Hydrogen ion concentration, Nutrients, Coliforms, Water temperature, Dissolved solids, Aquatic life, Data collections, *Bear Creek basin(OR), *Jackson County(OR).

Water-quality data identify surface-water-quality problems in Bear Creek basin, Jackson County, Oreg., where possible, their causes or sources. Irrigation and return-flow data show pastures are sources of fecal coliform and fecal streptococci bacteria and sinks for suspended sediment and nitrite-plus-nitrate nitrogen. Bear Creek and its tributaries have dissolved oxygen and pH values that do not meet State standards. Forty to 50% of the fecal coliform and fecal streptococci concentrations were higher than 1,000 bacteria colonies per 100 milliliters during the irrigation season in the lower two-thirds of the basin. During the irrigation season, suspended-sediment concentrations, average 35 milligrams per liter, were double those for the nonirrigation season. The Ashland sewage-treatment plant is a major source of nitrite plus nitrate, ammonia, and Kjeldahl nitrogen, and orthophosphate in Bear Creek. (USGS)
W81-01032

WATER-QUALITY ASSESSMENT OF THE PORTER COUNTY WATERSHED, KANKAKEE RIVER BASIN, PORTER COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-01035

MEASUREMENT OF MERCURY METHYLATION IN LAKE WATER AND SEDIMENT SAMPLES,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
A. Furutani, and J. W. M. Rudd.
Applied and Environmental Microbiology, Vol 40, No 4, p 770-776, October, 1980. 3 Fig, 2 Tab, 38 Ref.

Descriptors: *Mercury, *Microorganisms, *Radiochemical analysis, Analytical technique, Lakes, Freshwater, Lake sediments, Water pollution sources, Methylation, Ontario, Canada.

A new radiochemical technique was used to measure biological mercury methylation in the water column and sediments of Lake Clay (Ontario), a mercury contaminated lake. Samples were collected and incubated, and the solvent extraction method developed by Uthe et al. was modified to extract radioactive methylmercury produced during incubation of the samples. Confirmation of methylation and testing to see that non-biological isotopic exchange was not responsible for methylation were performed. Over a period of 24 weeks, three episodes of methylating activity were detected in the surface floc and in water, each lasting three to five weeks. Periods of methylation in the water column coincided with surface sediment methylation and appeared to be related to overall microbial activity. Mercury was actively methylated in the presence of bound sulfide. (Small-FRC)

W81-01047

DIRECT POTENTIOMETRIC WATER HARDNESS DETERMINATION USING ION-SELECTIVE ELECTRODES,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Dept. of Organic Chemistry.
P. C. Meier, D. Erne, Z. Cimerman, D. Ammann, and W. Simon.
Mikrochimica Acta, Vol 1, No 5/6, p 317-327, 1980. 3 Fig, 2 Tab, 15 Ref.

Descriptors: *Electrodes, *Hardness(Water), *Assay, Magnesium, Calcium, Water properties, Analytical techniques.

The use of ion-selective electrodes in water hardness determination was evaluated by determining those factors which bear on the measurement of the sum of concentrations of magnesium and calcium. The effects of these factors on the accuracy and precision of the assay were determined. To be competitive with other techniques, direct potentiometric water hardness determinations using ion selective electrodes must be restricted to relatively soft waters. The selectivity factor for magnesium, calcium, and sodium must be within 1.1% of unity if a hardness of 10 degree on the German scale is to be measured to within 0.1 degrees in the composition range of magnesium to calcium concentration ratios of 0.25 to 25. (Small-FRC)
W81-01051

THE EFFECT OF SURFACTANTS, CATIONS, AND COMPLEXING AGENTS ON THE SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM AMOUNTS OF URANIUM IN WATERS,
Australian Atomic Energy Commission Research Establishment, Lucas Heights.
P. Pakalns.
Mikrochimica Acta, Vol 1, No 5/6, p 339-344, 1980. 1 Tab, 5 Ref.

Descriptors: *Uranium radioisotopes, *Spectrophotometry, *Water analysis, Surfactants, Cations, Heavy metals, Chelation.

Bromo-PADAP (2-(5-bromo-2-pyridylazo)-5-diethyl-aminophenol) was used for the determination of uranium in the presence of surfactants, cations, and complexing agents in natural waters. Cationic, anionic, and non-ionic detergents, phosphate, soap, citric acid, Alamine-336, and mineral oil at concentrations of 100 mg/liter did not interfere in the determination of uranium. Iron(III), nickel(II), copper(II), chromium(III), and vanadium(V) gave additive errors but did not interfere when present in the usual concentrations found in natural waters. Sodium tripolyphosphate (100 ml) and sodium pyrophosphate (20 mg/liter) interfered badly, but a recovery rate of 98% was realized with the addition of 2 mg of thorium. Uranium can be detected at concentrations of 20 micrograms per liter in fresh water and 60 micrograms per liter in salt water if the water is not grossly contaminated with heavy metals. (Small-FRC)
W81-01052

CONCENTRATION AND DETERMINATION OF ORGANIC ACIDS IN COMPLEX AQUEOUS SAMPLES,
Ames Lab., IA.
J. J. Richard, C. D. Chriswell, and J. S. Fritz.
Journal of Chromatography, Vol 199, p 143-148, 1980. 5 Fig, 4 Ref.

Descriptors: *Pollutant identification, *Analytical techniques, *Anion exchange, Gas chromatography, Mass spectrometry, Flame photometry, Organic acids, Rivers, Running waters, Water pollution, Separation techniques, Anaerobic digestion, Waste water, Shales, Oil shales.

Concentration by anion exchange with subsequent elution, esterification, and gas chromatography (GC) is used to analyze water samples from a municipal anaerobic digester, river water and oil shale process water for acidic constituents. After extraction of the acidic sample solutes by anion exchange, neutral organic solutes can be concentrated and determined by conventional resin concentration-GC methods. Compounds identified in the water from the anerobic digester included: benzoic acid, caprylic acid, m-toluic acid, phenylacetic acid, phenylpropionic acid, 3,5-dimethylbenzoic acid, capric acid, B,B-dimethylphenylacetic acid, phenylbutyric acid, MCPP, myristic acid, palmitic acid, abietic acid, 2,4-D, DCPA, and 2,4-dichlorophenol. Compounds identified in the water samples taken from the Skunk River included: benzoic acid, lauric acid, myristic acid, palmitic acid, and stearic acid. The shale oil water samples had a high organic content which appeared to contain very large numbers of complex organic compounds. A considerable number of acidic sulfur compounds were present. The other major compounds appeared to be lower molecular weight carboxylic acids and aromatic acids. Thus the anion-exchange preconcentration procedure followed by esterification and GC analysis works well for a variety of complex aqueous samples. The method is preferable to solvent extraction for concentrating and measuring organic acidic components of water samples. (Baker-FRC)
W81-01067

CONCENTRATION AND DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN AQUEOUS SAMPLES ON GRAPHITIZED CARBON BLACK,
Rome Univ. (Italy). Ist. di Chimica Analitica.
A. Lagana, B. M. Petronio, and M. Rotatori.
Journal of Chromatography, Vol 198, No 2, p 143-149, October, 1980. 2 Fig, 3 Tab, 32 Ref.

Descriptors: *Adsorption, *Chromatography, *Aromatic compounds, Analytical techniques, Separation techniques, Water pollution, Organic compounds, Carbon, Rivers, Potable water, Solvents, Water analysis, Molecular structure, Curves.

Polycyclic aromatic hydrocarbons (PAH) are among the compounds for which the US EPA must set maximum limits in effluent waters. Since PAHs often occur in very low levels in water samples, a concentration step is often necessary before analysis. Graphitized carbon black (GCB) has been reported to have a high sorption capacity for certain organic micropollutants. GCB was tested as a concentration device for PAHs prior to liquid chromatography. Various GCB solvent systems (toluene, benzene, dichloromethane, acetonitrile, n-hexane and water) were each spiked with 6 different PAH compounds to estimate partition coefficients and percent recovery of the PAHs. Break-through plots were generated from samples of drinking water or river water to which the PAHs had been added and that were run through the GCB column prior to PAH analysis by high pressure liquid chromatography. Fluoranthene showed different retention and break-through volumes in river and drinking water suggesting the importance of the aqueous system used. Satisfactory recoveries of PAH were obtained using GCB concentration procedures when the composition of the water was considered. Molecular structure of the PAH also affects the efficiency of GCB recovery. The toluene-benzene-acetonitrile (5:2:3) solvent system was also found to give good results for PAH recovery by the GCB method. (Geiger-FRC)
W81-01068

TRACE ELEMENTS IN WATER AND BIOLOGICAL SAMPLES DETERMINED BY X-RAY SPECTROSCOPY,
Institut Rudjer Boskovic, Zagreb (Yugoslavia).
A. Ljubicic, I. Orlic, V. Valkovic, B. Bek, and S. Holjevic.
Progress in Water Technology, Vol 12, No 4, p 513-522, 1980. 5 Fig, 2 Tab, 9 Ref.

Descriptors: *Trace elements, *Water analysis, *X-ray spectroscopy, Chemical analysis, Analytical techniques, Marine animals, Sea water.

Concentrations of trace elements in sea water, drinking water, and marine organisms were determined simultaneously by X-ray spectroscopy. Sensitivities of methods involving three sources of radiation were compared. The proton method using MeV protons from a Van de Graaff accelerator exhibited the highest sensitivity. X-rays from the Mo-tube produced less sensitive results. However, proper choice of fluorescers can increase sensitivity. It is suggested that larger samples be used in the least sensitive method, whose radiation source is Fe55 and Cd109. (Cassar-FRC)
W81-01077

ANALYZING FOR TRACE CHEMICALS IN WATER: A MANAGER'S GUIDE,
D. W. Clark.
Public Works, Vol 111, No 11, p 85-89, November, 1980. 3 Fig.

Descriptors: *Analytical techniques, *Metals, Organic compounds, *Water analysis, *Trace elements, Spectroscopy, Testing procedures.

Commonly used techniques for analysis of trace contaminants in water are summarized and their advantages and weaknesses discussed. Trace metals may be concentrated by ion exchange, evaporation, solvent extraction, and freezing. Analytical methods described are atomic absorption, spectrophotometry, polarography, and neutron activation analysis. Organic compounds may be concentrated by the same methods used for metals, as well as by activated carbon absorption. Gas chromatography, mass spectroscopy, and infrared spectroscopy are widely used to characterize and quantify these compounds. (Cassar-FRC)
W81-01085

A VARIABLE-DEPTH GROUND-WATER SAMPLER,
Rhode Island Univ., Kingston. Dept. of Plant and Soil Science.
C. G. Galgowski, and W. R. Wright.
Soil Science of America Journal, Vol 44, No 5, p 1120-1121, September/October, 1980. 1 Fig, 8 Ref.

Descriptors: *Sampling, *Groundwater, Well casings, Water sampling, Aquifer testing, Water pollution, *Water wells, Instrumentation, Depth sampling, *Water analysis.

A variable-depth ground water sampler for 4 centimeter well casing pipe is described. This sampler, made from inexpensive materials, is adaptable to other sizes of well casings. It can extract water samples at any depth to a theoretical limit of 10 meters. Therefore, only one well is needed to sample pollutants at various depths in an aquifer. Construction materials include plastic tubing, rubber stoppers, bicycle inner tubing, hose clamps, a pressure gauge, 1 liter sample bottle, and a lead weight. By inflating the bicycle tubing, the intake tube can be located at any desired level in the casing. (Cassar-FRC)
W81-01088

RELATIONSHIP OF POLLUTION TO ROCKY SUBSTRATUM POLYCHAETES ON THE FRENCH MEDITERRANEAN COAST,
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
G. Bellan.
Marine Pollution Bulletin, Vol 11, No 11, p 318-321, November, 1980. 5 Fig, 3 Tab, 6 Ref.

Descriptors: *Bioindicators, *Annelids, *Rocks, *Coasts, Water pollution effects, Industrial wastes, Municipal wastes, Outfall sewers, Mediterranean, France.

Polychaetous annelids were studied in the area of the Mediterranean coast east of Marseille where the municipal sewer discharges and along the coast east of the Gulf of Fos, a heavily industrialized port. At different levels of different types of pollutants the distribution of polychaetes in the various rocky biotopes in the upper part of the infralittoral zone showed great qualitative homogeneity. About 15 species accounted for more than 90% of the collected individuals. The Annelid Index of pollution is presented, an index well correlated with the degree of pollution, as well as the Shannon-

Weaver diversity index. Indicator organisms for pollutants (Capitella capitata, Doreillea rudolphii, and others) are opposed to sentinel or detector organisms, which are indicators of pure water. The ratio of the sums of the dominances of these two species groups will furnish the Index. (Small-FRC)
W81-01099

PHOTOLYSIS OF 3,4-DICHLOROANILINE IN NATURAL WATERS,
Nevada Univ., Reno. Div. of Biochemistry.
G. C. Miller, R. Zisook, and R. Zepp.
Journal of Agricultural and Food Chemistry, Vol 28, No 6, p 1053-1056, November/December, 1980. 4 Fig, 4 Tab, 15 Ref.

Descriptors: *Photolysis, *3,4-Dichloroaniline, *Agricultural runoff, *Herbicides, Pesticide residues, Water pollution, Tetrachloroazobenzene, *Solar radiation, Humic acids, Pesticides, Pollutants, Irradiation.

Sunlight irradiation of 3,4-dichloroaniline (DCA) in natural water samples from three rice fields, the Sacramento River, and an alfalfa irrigation ditch resulted in both direct and sensitized photoreactions. A humic acid solution, used as a model natural water, exhibited sensitizing factors similar to those of natural waters. The photolysis rate in irradiated samples of distilled water containing 3,4-dichloroaniline was slower than in natural waters. Formation of 3,4,3',4'-tetrachloroazobenzene, which is similar to TCDD (2,3,7,8-tetrachlorodibenzo-para-dioxin) in structure and toxicological properties, was detected in DCA solutions in natural waters and humic acid solutions, but not in distilled water. Pollutants in natural waters may sensitize photolysis of DCA and may promote different photoproducts. (Cassar-FRC)
W81-01101

AUTOMATIC SEWAGE SAMPLERS: WHAT TO LOOK FOR WHEN BUYING,
EG and G Washington Analytical Services Center, Inc., Rockville, MD.
P. E. Shelley.
American City and County, Vol 95, No 10, p 35-38, October, 1980. 3 Tab.

Descriptors: *Automation, *Water sampling, Waste water, Sewage, Equipment, Water quality, Reviews, Costs, Water analysis.

Increasing legislation for water quality has necessitated improved methods for rapid and accurate wastewater sampling. Some guidelines are offered to aid in choosing the proper automatic sewage sampler from among the many models that are currently marketed. The most important consideration in selecting an automatic wastewater sampler is the type of sample that is desired. A brief review of several sample types including discrete samples, simple composite samples, flow proportional composite samples, sequential composite samples and continuous composite samples is presented. Sequential discrete sampling is generally desired for initial characterization of wastewater flows, and is generally required for stormwater sampling. In addition to twelve main considerations in the selection of an automatic liquid sampler, the equipment should be designed for easy maintenance and quick troubleshooting. An extensive summary of sampler characteristics gives data on the type of collection method used, the flow rate, line velocity and size, lift, sample type, type of installation, cost range, and power required for each unit. The wastewater sampler should be constructed of corrosion-resistant material that is easy to clean. Rapid changes in the automatic liquid sampler field are discussed along with the different sample gathering subsystems, which include suction lifts, vacuum pumps, pneumatic ejection, evacuated bottles and mechanical devices. A listing of automatic liquid sampler manufacturers in the United States and their addresses is also given. (Geiger-FRC)
W81-01103

DETERMINATIONS OF TRACE AMOUNTS OF 9,10-ANTHRAQUINONE IN AQUEOUS SYSTEMS BY DIFFERENTIAL PULSE POLAROGRAPHY,
Trondheim Univ. (Norway). Dept. of Chemistry.
J. O. Bronstad, K. H. Schroder, and H. O. Friestad.
Analytica Chimica Acta, Vol 119, No 2, p 243-249, 1980. 2 Fig, 11 Ref.

Descriptors: *Polarographic analysis, *Pollutant identification, Analytical techniques, 9,10-Anthraquinone, Water pollution, *Pulp wastes, Pulp and paper industry.

A differential pulse polarographic method for the determination of 9,10-anthraquinone is presented. The detection limit of the method is about 2 microg/ml with a standard deviation of 2.4%. The polarographic behavior of 9,10-anthraquinone is very sensitive to and thus dependent upon the nature of the solution and the supporting electrolyte. The most satisfactory results were obtained using 0.1 mg/l tetrabutylammonium tetrafluoroborate dissolved in methanol. Two methods are presented; one is used for cases in which strongly contaminated samples are to be analyzed. For determination of 9,10-anthraquinone in relatively pure substances such as natural waters, a direct extraction procedure with chloroform is recommended. Interfering compounds in the more complex samples are removed by a modified procedure involving steam distillation and extraction. (Baker-FRC)
W81-01106

EFFICIENCIES OF LIQUID-LIQUID EXTRACTION AND XAD-4 AND XAD-7 RESINS IN COLLECTING ORGANIC COMPOUNDS FROM A COKE PLANT'S EFFLUENT,
Illinois Environmental Protection Agency, Springfield.
D. J. Schaeffer, D. C. Tigwell, S. M. Somani, and K. G. Janardan
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 4, p 569-573, October, 1980. 2 Tab, 7 Ref.

Descriptors: *Water analysis, *Waste water pollution, *Sampling, *Organic compounds, *Coke plant effluents, Chemical analysis, Ion exchange resins, Separation techniques, Resins, Ion exchange, Industrial wastes, Effluents

Waste water from a coke plant was analyzed by gas chromatography and mass spectrometry to identify organic compounds and to determine the efficiency of collection methods: liquid-liquid extraction, XAD-4 and XAD-7 resins. The two resins recovered about 40 compounds each at 75% efficiency. By combining the two resins, 63 compounds were identified. Liquid-liquid extraction recovered 90 compounds at 65% efficiency. Using either resin with liquid-liquid extraction recovered about 110 compounds with efficiencies varying from 58.6 to 76.8%. When the total acid fractions were derivatized, 132 to 136 compounds were observed. Efficiency of collection varied from 63.8 to 97.1%. These results suggest that the characterization of complex wastes requires simultaneous collection of samples by several methods. (Cassar-FRC)
W81-01112

MUSSELS (MYTILUS EDULIS) AS 'POINT SOURCE' INDICATORS OF TRACE METAL POLLUTION,
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Chemistry.
J. D. Popham, D. C. Johnson, and J. M. D'Auria.
Marine Pollution Bulletin, Vol 11, No 9, p 261-263, September, 1980. 2 Fig, 9 Ref.

Descriptors: *Mussels, *Water pollution sources, *Outfall sewers, *Trace elements, Marine animals, Lead, Copper, Zinc, Vancouver(Canada), Burrard Inlet(Canada), Harbors, Storm drains, Metals, Bioindicators.

The common blue mussel, Mytilus edulis, was used as an indicator organism in a line transect study to locate within 30 meters a point source discharge of trace metals. Mussels close to a storm water outfall in the port of Vancouver, Canada, showed high levels of copper, zinc, and lead, while those only 30 meters away had baseline levels. A large difference in concentration of trace metals in mussels collected from different sides of one wharf was explained in that the wharf acts as a barrier against mixing of storm drainage water with sea water. The finding that trace metal concentrations in mussels decrease rapidly with distance from a point source indicates that mussels can be used to locate precisely (within 30 km) a point source discharge of trace metals. (Cassar-FRC)
W81-01115

TAXONOMY, POLLUTION AND SLUDGE WORM,
Institute of Ocean Sciences, Sidney (British Columbia). Ocean Ecology Lab.
R. O. Brinkhurst.
Marine Pollution Bulletin, Vol 11, No 9, p 248-251, September, 1980.

Descriptors: *Bioindicators, *Sludge worms, *Oligochaetes, Toxicity, Systematics, Reviews, Biological communities, Water pollution.

This essay on the taxonomy of worms used as bioindicators of pollution discusses the various species of oligochaetes. Although there are about 1000 species known, biologists only have to identify 20 to 30 species on a global basis and only one or two dozen in any habitat type. M ost of the interest in pollution biology deals with field detection methods rather than physiological/toxicological approaches. Family level is usually used rather than species. The development of diversity indexes and the study of toxicology have led to the expansion of interest in worms. The first world meeting of specialists was held in 1979 and included reports on sludge worm taxonomy, evolution, zoogeography, toxicology, life histories, and niche discrimination. (Small-FRC)
W81-01117

GAS CHROMATOGRAPHY COMBINED WITH MASS SPECTROMETRY FOR THE IDENTIFICATION OF ORGANIC SULFUR COMPOUNDS IN SHELLFISH AND FISH,
Okayama Univ. (Japan). Dept. of Public Hygiene
For primary bibliographic entry see Field 5C
W81-01123

PSYCHROPHILES, PSYCHROTROPHS, AND MESOPHILES IN AN ENVIRONMENT WHICH EXPERIENCES SEASONAL TEMPERATURE FLUCTUATIONS,
Laurentian Univ., Sudbury (Ontario). Dept. of Biology.
G. D. Ferroni, and J. S. Kaminski.
Canadian Journal of Microbiology, Vol 26, No 10, p 1184-1191, October, 1980. 9 Tab, 9 Ref

Descriptors: *Microorganisms, *Sediment-water interfaces, *Temperature, Seasonal, Bacteria, Lakes, Canada.

Psychrophilic/psychrotrophic and mesophilic, heterotrophic bacteria were quantified in sediment-water interface samples from a lake which experiences seasonal temperature fluctuations. The psychrophilic/psychrotrophic population ranged from 1212 to 87,000 per ml, and the mesophilic population ranged from 67 to 3783 per ml over the yearly cycle. Pyschrophilic/psychrotrophic bacteria predominated on every sampling occasion. A considerable number of isolates at 37 C were psychrotrophs with broad temperature ranges for growth. A total of 388 isolates were determined and were grouped into 158 working types based on Gram reaction, colony and cell morphology, biochemical activities, and thermal type. (Small-FRC)
W81-01124

EVALUATION OF STEADY-STATE-BIOFILM KINETICS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. E. Rittmann, and P. L. McCarty.
Biotechnology and Bioengineering, Vol 22, No 11, p 2359-2373, November, 1980. 6 Fig, 20 Ref.

Descriptors: *Kinetics, *Organic matter, *Microorganisms, Impaired water quality, Waste water(Pollution), Laboratory tests.

The results of an experimental evaluation of the steady-state model of biofilm kinetics and the concept of minimum substrate concentration are presented. With acetate as the growth medium in laboratory-scale biofilm reactors, the steady-state concept of minimum substrate concentration was verified for naturally grown biofilms. As the substrate reached the minimum substrate concentration (0.66 mg/liter for acetate), substrate removal and biofilm thickness declined rapidly. The model successfully predicted substrate utilization and biofilm thickness using independently derived kinetic parameters. The results indicate that organic materials may persist in water and waste water partially because they are in too low concentration to supply sufficient energy to sustain the microorganisms. (Small-FRC)
W81-01125

DETERMINATION OF THE AQUEOUS SOLUBILITIES OF ORGANIC LIQUIDS AT 10.0, 20.0, AND 30.0 C BY ELUTION CHROMATOGRAPHY,
National Bureau of Standards, Washington, DC. National Measurement Lab.
F. P. Schwarz, and J. Miller.
Analytical Chemistry, Vol 52, No 13, p 2162-2164, November, 1980. 3 Tab, 14 Ref.

Descriptors: *Organic compounds, *Solubility, *Chromatography, Solvents, Aqueous solutions, Analytical techniques, Spectrophotometry, Temperature, Toxins, Path of pollutants, Water pollution, Aromatic compounds, Pollutant identification.

To better understand the fate and solubility properties of toxic organics in the aquatic environment, the solubilities of several organic liquids were determined at various temperatures by elution chromatography. Aqueous solubilities of cholorbenzene, m-dichlorobenzene, diethyl phthalate, dibutyl phthalate, toluene, 1,1,1-trichloroethane and 1,1,2,2-tetrachloroethane were determined at 10.0, 20.0, and 30.0 C. Aqueous solubilities of ethylbenzene and o-dichlorobenzene were determined at 20.0 and 30.0 C. Results from the benzene derivatives were compared with those determined by UV absorption measurements made on the solution phase. Of the nineteen benzene solubilities determined by elution chromatography, fifteen were in agreement with results obtained by UV absorption within an experimental error of 4%. Elution chromatography results for the chloroethane derivatives were in even closer agreement with aqueous solubilities measured by UV absorption, with an experimental error of 2%. Solubilities recorded ranged from 0.00111 wt% for dibutyl phthalate at 20.0 C to 0.385 wt% for 1,1,2,2-tetrachloroethane at 20.0 C. (Geiger-FRC)
W81-01127

A WELL-HEAD INSTRUMENT PACKAGE FOR MULTI-PARAMETER MEASUREMENT DURING WELL WATER SAMPLING,
California Univ., Livermore. Environmental Sciences Div.
G. Garvis, and D. H. Stuermer.
Water Research, Vol 14, No 10, p 1525-1527, October, 1980. 3 Fig, 4 Ref.

Descriptors: *Design criteria, *Groundwater, *Water wells, Data collections, Monitoring, Water sampling, *Water analysis, Well data, Design data, Wells, Water pollution, Data transmission, Measurement, Sampling, Hydrogen ion concentration, Oxidation-reduction potential, Conductivity, Temperature.

A new design for a portable well-head instrument package improves groundwater sampling and continuous monitoring of pH, redox potential, conductivity and temperature. These parameters are considered useful indicators of possible contamination from the well itself. The new instrument consists of probes attached to the well-head and connected to digital display meters housed in a separate insulated carrying case. This system has been used in several monitoring programs. It functions reliably, is convenient and improves the accuracy of pH and redox potential measurements. (Titus-FRC)
W81-01138

SEDIMENT OXYGEN DEMAND TECHNIQUES: A REVIEW AND COMPARISON OF LABORATORY AND IN SITU SYSTEMS,
Wisconsin Univ., Madison. Lab. of Hygiene.
G. T. Bowman, and J. J. Delfino.
Water Research, Vol 14, No 5, p 491-499, May, 1980. 3 Fig, 10 Tab, 56 Ref.

Descriptors: *On-site laboratories, *Analytical techniques, *Sediments, *Water analysis, *Chemcial oxygen demand, Testing procedures, Water pollution, Laboratory tests, Materials testing, Dissolved oxygen, Water measurement, Sampling, Instrumentation.

Sediment oxygen demand measurement techniques are reviewed and improvements are recommended. In comparisons of data from among two or more techniques, methodological differences were identified as the greatest source of variations. Five principal analytical systems are used to evaluate sediment oxygen demand: (1) batch, which includes laboratory and in situ; (2) continuous flow; (3) manometric; (4) electrolytic; and (5) dehydrogenase activity. Comparison of methods requires establishment of criteria to determine whether the methods are acceptable. These criteria are: (1) consistency; (2) reproducibility; and (3) efficiency. Laboratory techniques meet the criteria more readily than in situ techniques, because many factors including temperature, turbidity, light, and current velocity cannot be controlled in situ. A sediment oxygen demand reaction chamber has been designed and meets the criteria. It gives an optimum volume to surface ratio and provides results in less than 24 hours. Based on experiments, the 24 hour period decreases the possiblity of error due to initial chemical oxygen demand. (Titus-FRC)
W81-01149

CHEMICAL AND SPECTROSCOPIC CHARACTERIZATION OF HUMIC SUBSTANCES DERIVED FROM RIVER SWAMPS IN THE FLOOD PLAINS OF SOUTHEASTERN U.S. COASTAL STREAMS,
Georgia Inst. of Tech., Atlanta. School of Geophysical Sciences.
J. H. Reuter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150245, Price codes: A05 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology, Project Completion Report ERC 06-08, September, 1980. 66 p, 16 Fig, 11 Tab, 23 Ref. OWRT-B-132-GA(1).

Descriptors: *Chemical analysis, *Spectroscopy, *Soil analysis, *Humic acids, *Fulvic acids, *Swamps, *Flood plains, Coasts, Instrumentation, Nutrients, Analysis, Decomposing organic matter, Organic soils, Acids, Organic compounds, Chelation, Wetlands, Humus, Trace elements, Soil chemical properties.

Samples were taken from surface peat from the Okefenokee swamp, from surface soils and sediment cores in the Altamaha flood plain, and analyzed. Several distinct fractions of river swamp related humic substances were identified by chemical/spectroscopic methods. The results showed that humic substances are abundantly synthesized in river swamps and are both stored in soils and exported into the overlying or percolating waters. Water-soluble humus derived from peat appeared to be of a lower degree of humification and condensation than both the aquatic humus from swamp waters and swamp soil fulvic acids (FA), and may hence be a chemical precursor of both. Aquatic humus resembled soil FA in chemical composition and acidic functional group content (AFGC). Relative to 'average' soils, swamp soils were depleted in low molecular weight FA, probably due to intensive percolation by flood waters. Data on soil humic acids (HA) and FA abundance and their AFGC were used to estimate metal-binding capacities of the swamp soil due to humic substances. Metal-binding studies with swamp soil HA and FA confirmed their ability to complex potential pollutant metals. (Zielinski-IPA)
W81-01158

A STATISTICAL ANALYSIS OF THE QUALITY OF SURFACE WATER IN NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-01180

5B. Sources Of Pollution

ASBESTOS FIBRES IN RECEIVING WATERS,
Department of the Environment, Vancouver (British Columbia). Pacific Region.
For primary bibliographic entry see Field 5A.
W81-01013

ST. LAWRENCE RIVER WATER QUALITY SURVEYS, 1977,
Canada Centre for Inland Waters, Burlington (Ontario).
C. H. Chan.
Scientific Series No 113, 1980. 16 p, 17 Fig, 3 Tab, 9 Ref.

Descriptors: *Water quality, Nutrients, *Surveys, Mean concentrations, Physical parameters, Ions, Metals, *St. Lawrence River, Sampling, Surveys, Data collection, Polychlorinated biphenyls, Water pollution sources, *Path of pollutants, International waters.

Six water quality surveys were carried out in 1977 on the international section of the St. Lawrence River. Results compared with 1973-1974 data showed no apparent change in the water quality of the river. Nutrient concentrations (nitrate and phosphorus) increased progressively downstream, especially downstream from Brockville. High inputs of metals from United States tributaries were found in areas of the St. Lawrence below Massena. High levels of PCB were detected in the Grass River. (WATDOC)
W81-01014

STATISTICAL ANALYSES OF SURFACE-WATER-QUALITY VARIABLES IN THE COAL AREA OF SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
J. R. Knapton, and R. F. Ferreira.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226020, Price codes: A07 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-40, June, 1980. 128 p, 2 Fig, 4 Tab, 17 Ref.

Descriptors: *Water quality, *Streams, *Montana, Coal mines, *Chemical analysis, Anions, Cations, Dissolved solids, Specific conductivity, Trace elements, Sediment transport, Water temperature, Path of pollutants, Water utilization, Irrigation, Cattle, Water analysis, Evaluation, *Southeastern Montana.

Since 1974 a network of water-quality stations has been operated in the coal area of southeastern Montana. This report updates a previous report with 2 years of additional data collection and presents statistics and regression equations for water-quality variables. The most apparent feature of the study is the variability of water quality. Time-trend differences are most noticeable, with areal differences being present but more subtle. In comparing stations at the mouths of the five major drainages entering the Yellowstone River from the study area, water from the Powder River ranks near the middle of the group in dissolved-solids concentration (mean of 1,390 mg/L), but far exceeds the other drainages in suspended-sediment concentration, often exceeding 10,000 mg/L. The Tongue River generally has the best overall quality with respect to dissolved constituents; extremes are moderated by mixing in the Tongue River Reservoir.

Suspended sediment ranged from 5 to 4,360 mg/L. Rosebud Creek shows about a 50-percent average increase in dissolved-solids concentration from the most upstream station to the mouth. Armells and Sarpy Creeks, smallest of the five drainages, have a pool-riffle configuration that influences both dissolved and suspended constituents. Pools permit greater evaporation, thus increasing dissolved-constituent concentrations. They also act as sediment traps. (USGS)
W81-01023

A ONE-DIMENSIONAL, STEADY-STATE, DISSOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR LITTLE LAUGHERY CREEK, RIPLEY AND FRANKLIN COUNTIES, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
C. G. Crawford, W. G. Wilber, and J. G. Peters.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $9.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-74, January, 1980. 64 p, 24 Fig, 11 Tab, 57 Ref.

Descriptors: *Model studies, *Dissolved oxygen, *Waste assimulative capacity, *Water quality, *Indiana, Streams, Streamflow, Low flows, Reaeration, Water pollution, Waste water disposal, Waste water treatment, Biochemical oxygen demand, Nitrification, Ammonia, Nitrates, Nutrients, Mathematical models, *Ripley County(IN), *Franklin County(IN), Little Laughery Creek(IN).

A digital model calibrated to conditions in Little Laughery Creek triutary and Little Laughery Creek, Ripley and Franklin Counties, Ind., was used to predict alternatives for future waste loadings that would be compatible with Indiana stream water-quality standards defined for two critical hydrologic conditions, summer and winter low flows. Natural streamflow during the summer and annual 7-day, 10-year low flow is zero. Headwater flow upstream from the wastewater-treatment facilities consists solely of process cooling water from an industrial discharger. This flow is usually less than 0.5 cubic foot per second. Consequently, benefits from dilution are minimal. As a result, current and projected ammonia-nitrogen concentrations from the municipal discharges will result in in-stream ammonia-nitrogen concentrations that exceed the Indiana ammonia-nitrogen toxicity standards (maximum stream ammonia-nitrogen concentrations of 2.5 and 4.0 milligrams per liter during summer and winter low flows, respectively). Benthic-oxygen demand is probably the most significant factor affecting Little Laughery Creek and is probably responsible for the in-stream dissolved-oxygen concentration being less than the Indiana stream dissolved-oxygen standard (5.0 milligrams per liter) during two water-quality surveys. After municipal dischargers complete advanced waste-treatment facilities, benthic-oxygen demand should be less significant in the stream dissolved-oxygen dynamics. (USGS)
W81-01025

WATER RESOURCES OF BOULDER COUNTY, COLORADO,
Geological Survey, Denver, CO. Water Resources Div.
D. C. Hall, D. E. Hillier, D. Cain, and E. L. Boyd.
Available from the Colo. Geol. Survey, 1313 Sherman St., Denver, CO 80202, Price: $8.00 in paper copy. Colorado Department of Natural Resources Bulletin 42, 1980. 97 p, 19 Fig, 1 Plate, 23 Tab, 56 Ref.

Descriptors: *Water resource, *Colorado, *Water quality, *Groundwater, *Surface waters, Streamflow, Precipitation(Atmospheric), Evapotranspiration, Surface runoff, Hydrogeology, Water wells, Aquifers, Aquifer characteristics, Water yield, Water table, Water quality standards, Septic tanks, Water pollution sources, Hydrologic data, *Boulder County(CO), South Platte River basin(CO), Front Range Urban Corridor(CO).

Surface water is abundant in Boulder County, Colo., because large amounts of precipitation fall in the higher mountains and this precipitation feeds the streams directly or indirectly throughout the year. Ground water is an important source of water mostly for domestic, stock, or limited-acreage irrigation needs. The most frequently used aquifers are flood plain, terrace, Laramie-Fox Hills, Pierre-Niobrara-Benton, and crystalline rock. Median well yields of 15 or more gallons per minute occur for the flood plain, terrace, and Laramie-Fox Hills aquifers. The chemical and bacterial quality of the surface water is best at higher altitudes and decreases as the streams flow easterly to the plains and leave the county. The changes in water quality are influenced by the hydrogeology and the activities of man such as mining, farming, and sewage disposal. Many sources of water examined failed to meet Colorado Department of Health water-quality standards for raw drinking-water use, for agricultural use, and for aquatic life. Chemical quality of the ground water, particularly dissolved solids, is better in water from the unconsolidated- and crystalline-rock aquifers in the mountains and decreases in the aquifers on the plains. Factors involved in the decrease of quality are the geohydrology and the quality of associated surface water. Local contamination of ground water by subsurface wasterwater disposal is a frequent problem. (USGS)
W81-01031

WATER QUALITY OF BEAR CREEK BASIN, JACKSON COUNTY, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-01032

WATER-QUALITY ASSESSMENT OF THE PORTER COUNTY WATERSHED, KANKAKEE RIVER BASIN, PORTER COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div
L. L. Bobo, and D. E. Renn
Available from the OFSS, USGS Box 25425, Fed Ctr., Denver, CO 80225, Price: $7.50 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 80-331, February, 1980. 54 p, 9 Fig, 11 Tab, 27 Ref.

Descriptors: *Water quality, *Surface waters, *Watersheds(Basins), *Municipal wastes, *Indiana, Streams, Water analysis, Chemical analysis, Water pollution sources, Dissolved solids, Dissolved oxygen, Sediments, Bacteria, Pesticides, Polychlorinated biphenyls, Coliforms, Phytoplankton, Evaluation, *Kankakee River basin, Porter County(IN).

Water type in the 241-square mile Porter County watershed in Indiana, was calcium bicarbonate or mixed calcium bicarbonate and calcium sulfate. Concentrations of dissolved chemical constituents in surface water and contents of chlorinated hydrocarbons in streambed samples in the watershed were generally less than water-quality alert limits set by the U.S. Environmental Protection Agency, except in Crooked Creek. During sampling, this stream was affected by sewage, chlorinated hydrocarbons, and two chemical spills. Ranges of on-site field measurements were: specific conductance, from 102 to 1,060 micromhos per centimeter at 25 Celcius; water temperature, from 7.0 to 31.8 Celsius; pH, from 6.8 to 8.9; dissolved oxygen, from 2.5 to 14.9 milligrams per liter and from 27 to 148% saturation; and instantaneous discharge from 0 to 101 cubic feet per second. Concentrations of most dissolved-inorganic constituents (heavy metals and major ions) and dissolved solids did not vary significantly from one sampling period to the next at each site. Dissolved constituents whose concentrations varied significantly were iron, manganese, organic carbon, ammonia, nitrate plus nitrite, organic nitrogen, Kjeldahl nitrogen, and phosphorus. Concentrations of dissolved manganese, organic carbon, dissolved nitrite plus nitrate, and suspended sediment varied seasonally at most sites. Populations and identification of bacteria, phytoplankton, periphyton, and benthic invertebrates indicate a well-balanced environment at most sites, except in Crooked Creek. (USGS)
W81-01035

AN ECONOMIC ANALYSIS OF SELECTED STRATEGIES FOR DISSOLVED-OXYGEN MANAGEMENT: CHATTAHOOCHEE RIVER, GEORGIA,
Geological Survey, Reston, VA. Water Resources Div.
J. E. Schefter, and R. M. Hirsch.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.00. Geological Survey Professional Paper 1140, 1980. 26 p, 16 Fig, 13 Tab, 5 Ref, Append.

Descriptors: *Cost analysis, *Dissolved oxygen, *Streams, *Water pollution sources, *Georgia, Water quality control, Planning, Powerplants, Inflow, Waste assimilative capacity, Model studies, Simulation analysis, Economic efficiency, Evaluation, *Chattahoochee River(GA), *Buford Dam(GA).

A method for evaluating the cost-effectiveness of alternative strategies for dissolved-oxygen (DO) management is demonstrated, using the Chattahoochee River, GA., as an example. The conceptual framework for the analysis is suggested by the economic theory of production. The minimum flow of the river and the percentage of the total waste inflow receiving nitrification are considered to be two variable inputs to be used in the production of given minimum concentration of DO in the river. Each of the inputs has a cost: the loss of dependable peak hydroelectric generating capacity at Buford Dam associated with flow augmentation and the cost associated with nitrification of wastes. The least-cost combination of minimum flow and waste treatment necessary to achieve a prescribed minimum DO concentration is identified. Results of the study indicate that, in some instances, the waste-assimilation capacity of the Chattahoochee River can be substituted for increased waste treatment; the associated savings in waste-treatment costs more than offset the benefits foregone because of the loss of peak generating capacity at Buford Dam. The sensitivity of the results to the estimates of the cost of replacing peak generating capacity is examined. It is also demonstrated that a flexible approach to the management of DO in the Chattahoochee River may be much more cost effective than a more rigid, institutional approach wherein constraints are placed on the flow of the river and(or) on waste-treatment practices. (USGS)
W81-01036

GEOCHEMISTRY OF WATER IN THE FORT UNION FORMATION OF THE NORTHERN POWDER RIVER BASIN, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
R. W. Lee
Available from the OFSS, USGS Box 25425, Fed Ctr., Denver, CO 80225, Price: $8.00 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 80-336 (WRI), June, 1980. 17 p, 7 Fig, 2 Plates, 2 Tab, 18 Ref.

Descriptors: *Geochemistry, *Groundwater, *Water quality, *River basins, *Montana, Hydrogeology, Streams, Water chemistry, Springs, Water wells, Bacteria, Cation exchange, *North Powder River basin(MT), Southeastern Montana

Shallow water in the coal-bearing Fort Union Formation of southeastern Montana was investigated to provide a better understanding of the geochemistry. Springs, wells less than 200 feet deep, and wells greater then 200 feet deep were observed to have different water qualities. Overall, the ground water exists as two systems: a mosaic of shallow, chemically dynamic, and localized recharge-discharge cells superimposed on a deeper, chemically static regional system. Water chemistry is highly variable in the shallow system, whereas sodium and bicarbonate waters characterize the deeper system. Within the shallow system, springs, and wells less than 200 feet deep show predominantly sodium and sulfate enrichment processes from recharge to discharge. These processes are consistent with the observed aquifer mineralogy and aqueous chemistry. However, intermittent mixing with downward moving recharge waters or upward

moving deeper waters, and bacterially catalyzed sulfate reduction, may cause apparent reversals in these processes. (USGS)
W81-01041

INPUT INTO AND FATE OF LEAD IN A SMALL RESERVOIR,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
A. W. McIntosh, J. V. Hunter, and P. Krug.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-148074, Price codes: A03 in paper copy, A01 in microfiche. Final Technical Completion Report, October, 1980, 31 p, 3 Fig, 13 Tab, 27 Ref. OWRT-A-056-NJ(1), 14-34-0001-0132.

Descriptors: *Lead, Heavy metals, *Storm runoff, *Reservoirs, Inflow, *Land use, Environmental effects, Drainage area, Sediments, Cores, Sampling, Fish physiology, New Jersey, *Weston's Mill Pond(NJ).

Lead (Pb) concentrations in water samples collected from seven sites in Weston's Mill Pond, NJ., a water supply/recreation reservoir exposed to substantial amounts of highway runoff, under varying meteorological conditions ranged from 18.3 to 34.9 ug/l. Highest average concentration over all sites (46.4 ug Pb/l) occurred after a period of heavy rainfall. The non-filterable fraction accounted for 80 to 96% of the total lead present in the water. Lead concentrations in the upper 2 cm of sediment cores were as high as 439.7 ug/g (dry weight), and elevated levels existed throughout the cores (22.5 cm in depth) at some sites. Lead concentrations in the tissues of four species of fish collected from the reservoir consistently occurred in the following order: gills > liver > muscle, with levels in the muscle less than 1 ug Pb/g (dry weight basis). Estimated loading of lead to the reservoir via a major tributary during a storm event was 3.22 pounds, with levels in the tributary reaching a maximum of 1.94 mg Pb/l during the storm. (McIntosh-Rutgers)
W81-01045

BEHAVIOUR OF PHOSPHATE IN ESTUARINE WATER,
Melbourne Univ., Parkville, (Australia), Marine Chemistry Lab.
J. D. Smith, and A. R. Longmore.
Nature, Vol 287, No 5782, p 532-534, October 9, 1980. 3 Fig, 1 Tab, 21 Ref.

Descriptors: *Phosphates, *Estuaries, *Iron compounds, *Water pollution, *Yarra River(Australia), Humic acids, Waste water(Pollution), Rivers, Sedimentology, Model studies, Phosphorus compounds, Inorganic compounds, Laboratory tests.

Since 1977 measurements of phosphate during high and low flow in the waters of the Yarra River estuary (Australia) showed wide variations, laboratory experiments were designed to study some of the non-biological factors in phosphate distribution. Results showed that the sequence and concentration of the additions of iron, humic acid, and phosphate to the river largely controlled the proportion of phosphate removed from solution in river water. Less than 10% inorganic removal of phosphate occurred in estuaries fed by rivers of average iron content. In the laboratory system, sea water was pumped into a vessel containing river water, and the mixture pumped out at the same rate. In the sample of river water used, 94.5% of the iron and 42% of the phosphate were associated with the particulate matter. Removal of iron was 70%; humic acid, 23%; and phosphate, 6%, with the salinity of maximum removal different for each component. A series of experiments using synthetic starting solutions showed that a maximum of 44% phosphate was removed in the presence of high levels of iron and humic acid (starting solution, 9 mg humic acid, 750 mg iron, and 200 micrograms phosphate per liter). (Cassar-FRC)
W81-01050

ALGAL AVAILABILITY OF SEDIMENT PHOSPHORUS IN DRAINAGE WATER OF THE BLACK CREEK WATERSHED,
Purdue Univ., Lafayette, IN. Agricultural Experimental Station.
R. A. Dorich, D. W. Nelson, and L. E. Sommers.
Journal of Environmental Quality, Vol 9, No 4, p 557-563, October/December, 1980. 1 Fig, 4 Tab, 18 Ref.

Descriptors: *Agricultural watersheds, *Phosphorus, *Algae, Sediment-water interfaces, Laboratory tests, Sediment load, Indiana, Eutrophication.

The algal availability of phosphorus in suspended stream sediments of the Black Creek Watershed (Indiana) and the phosphorus fractions in suspended stream sediments which are available to algae were evaluated. Sediments suspended in the agricultural watershed were separated, resuspended in a nutrient medium, inoculated with Selanastrum capricornutum, and incubated for two weeks under illumination. Before and after incubation, the media were analyzed for algal numbers and phosphorus assimilated by algal cells by sequential extraction with NH4F, NaOH, and HCl. Available sediment phosphorus in March and June samples averaged 20.7% of the total sediment phosphorus and 30.1% of the sediment inorganic phosphorus. Sediment phosphorus contributed significantly larger quantities of phosphorus than soluble phosphorus for algal growth during incubation. (Small-FRC)
W81-01058

LITTERFALL, STEMFLOW, AND THROUGHFALL NUTRIENT FLUXES IN AN ALLUVIAL SWAMP FOREST,
East Carolina Univ., Greenville, NC. Dept. of Biology.
M. M. Brinson, H. D. Bradshaw, R. N. Holmes, and J. B. Elkins, Jr.
Ecology, Vol 61, No 4, p 827-835, August, 1980. 2 Fig, 4 Tab, 51 Ref.

Descriptors: *Nutrients, *Swamps, *Forests, Stemflow, Leaves, Humus, Cycling nutrients, Wetlands, Throughfall, Fluctuations, Canopy, Seasonal, Leaching, Weathering.

The nutrient cycling capacity of an alluvial forest of the Coastal Plain of North Carolina was compared with other wetland and upland ecosystems on which data was available. Sediments in the alluvial swamp forest are characterized by a higher concentration of exchangeable calcium and potassium and support more rapid growth of the water tupelo, Nyssa aquatica, than soils in non-alluvial headwater swamps. The annual litterfall of the study area was 6428 kilograms dry mass/hectare; 63% of this was N. aquatica leaves. Deposition of nutrients onto the forest floor in kilograms/hectare/year for litterfall and aqueous sources, respectively, were calculated to be 2779 and 91.5 for organic carbon, 5.38 and 1.55 for phosphorus, 17.0 and 7.60 for magnesium, 72.77 and 10.31 for nitrogen, 7.19 and 9.21 for sulfur, 45.1 and 15.31 for calcium, and 21.1 and 11.96 for potassium. Values for these nutrients in mature upland temperate forests and still-water swamps have been reported to be lower. The high values for nitrogen and phosphorus in the alluvial forests were suspected of originating from fluvial sources, while atmospheric sinks and weathering formed the major nutrient inputs for upland forests and still-water swamps. (Geiger-FRC)
W81-01065

DETRITAL PROCESSING AND ASSOCIATED MACROINVERTEBRATES IN A COLORADO MOUNTAIN STREAM,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
R. A. Short, S. P. Canton, and J. V. Ward.
Ecology, Vol 61, No 14, p 727-732, August, 1980. 5 Fig, 3 Tab, 18 Ref.

Descriptors: *Natural streams, *Leaves, *Invertebrates, Degradation, Organic matter, Organic loading, Colorado.

A study of leaf processing in a Colorado mountain stream was initiated to determine the processing rates of four common species of leaves, the nature of the macroinvertebrates which colonize leaf litter, the importance of leaf litter as a source of, or collecting system for, fine particulate organic detritus, and finally, the importance of leaf litter as a habitat for fine particle-feeding detritivores. Processing occurred at rapid rates despite water temperatures at or near zero degrees centigrade. A high biomass of shredders was found per gram of leaf pack, which explains the rapid processing. Fine particulate organic matter may accumulate in leaf packs from two potential sources: leaf material in the pack as it is processed, and fine organic matter in transport which is trapped in the leaf pack. (Small-FRC)
W81-01066

PHOTOLYSIS OF 3,4-DICHLOROANILINE IN NATURAL WATERS,
Nevada Univ., Reno. Div. of Biochemistry.
For primary bibliographic entry see Field 5A.
W81-01101

VARIABILITY AND LOADING OF MERCURY IN A SMALL PRAIRIE RIVER,
W. D. Gummer.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 4, p 530-536, October, 1980. 4 Fig, 14 Ref.

Descriptors: *Mercury, *Rivers, *Sediments, *Water pollution, *Moose Jaw River(Saskatchewan), Thunder Creek, Saskatchwan, Pollutants.

The magnitude and variability of mercury levels in the Moose Jaw River, Saskatchewan, were investigated during a high flow period. Water samples of 500 ml were collected hourly for 35 days, April 18 to May 22, 1979. The maximum total mercury level, 0.13 micrograms per liter, in water samples occurred at peak flow and corresponded with suspended sediment and particulate organic carbon maxima. Suspended sediment mercury levels were generally 0.15 micrograms per gram. However, on one occasion, erosion in the Thunder Creek tributary produced a suspended sediment mercury concentration of 0.58 microliters per gram. Although particulate mercury was the predominant form, dissolved mercury increased slightly during peak flow, with maximum levels coinciding with a drop in suspended sediment and particulate organic carbon levels. (Cassar-FRC)
W81-01110

MUSSELS (MYTILUS EDULIS) AS 'POINT SOURCE' INDICATORS OF TRACE METAL POLLUTION,
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W81-01115

COINCIDENCE OF CADMIUM AND ANTIBIOTIC RESISTANCE IN NEW YORK BIGHT APEX BENTHIC MICROORGANISMS,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
M. A. Devanas, C. D. Litchfield, C. McClean, and J. Gianni.
Marine Pollution Bulletin, Vol 11, No 9, p 264-269, 1980. 1 Fig, 2 Tab, 26 Ref.

Descriptors: *Chemicals, *Cadmium, *Benthic fauna, *Microorganisms, *Atlantic Ocean, Water pollution sources, Sludge disposal, Industrial wastes, Spoil banks, Dredging, Antibiotic resistance, Drug resistance, *New York Bight apex.

Microorganisms resistant to 1-500 ppm cadmium were isolated and tested for antibiotic resistances. Sediment samples were collected in the New York Bight apex in a sewage sludge disposal area, a dredge spoils area, an industrial acid wastes dumping area, and other sites. Sixty-nine cadmium resistant isolates were tested for antibiotic resistance with a spectrum of antibiotics: sulfachloropyridazine, penicillin, bacitracin, tetracycline compounds, streptomycin mixture, novobiocin, neomycin, nalidixic acid, ampicillin, kana-

mycin, and chloramphenicol. Ninety-four percent of the microorganisms exhibited antibiotic resistance to at least one of the compounds tested, while 91% displayed a multiple drug resistance pattern. The possibility of extrachromosomal linkage of cadmium and streptomycin resistance is discussed. (Small-FRC)
W81-01116

VIRUSES IN GROUNDWATER,
Baylor Coll. of Medicine, Houston, TX.
B. H. Keswick, and C. P. Gerba.
Environmental Sciences and Technology, Vol 14, No 11, p 1290-1297, November, 1980. 1 Fig, 6 Tab, 56 Ref.

Descriptors: *Water quality, *Viruses, *Groundwater, Waste disposal, Land use, Public health, Diseases, Water pollution sources, Reviews.

A literature review is presented on viruses in groundwater in order to evaluate the present state of knowledge, assess current standards and monitoring practices, and recommend areas of research. Viruses have been isolated from groundwater sources and drinking water and from sites where land application or waste water experimentation is practiced. These viruses include Echo, Polio, Coxsackie, Rota, and B viruses. There are a growing number of studies of isolation of viruses in groundwater after land application of wastes, although there have been no disease outbreaks associated with these sites. More studies are needed on the survival of viruses in groundwater and their ability to migrate long distances. Also, monitoring virus concentration in land application areas after rainfall and under various geological conditions is proposed. (Small-FRC)
W81-01121

MASS BALANCE,
Anglian Water Authority, Huntingdon (England). Directorate of Resource Planning.
A. E. Warn, and J. S. Brew.
Water Research, Vol 14, No 10, p 1427-1434, October, 1980. 2 Fig, 4 Tab, 13 Ref.

Descriptors: Discharge, *Discharge measurement, *Flow, Monte Carlo method, *Effluents, *Hydrologic equation. Simulation analysis, *Model studies, Channel flow, Hydraulics, Water pollution, Mathematical studies, Statistical models, Computer models, Numerical analysis, Surface waters, Computers, Water quality control.

Two methods for calculating mean and percentile values of river quality downstream of a discharge are compared. Both relate percentile values of downstream water quality to percentile values of discharge quality, producing more accurate results than with a simple mass balance. The analytical method can be used on a programmable calculator, while the Monte Carlo method is versatile because it can cope with data that are not log-normal and with correlation between the variables. It is particularly useful in problems of pollution control by river flow augmentation. It gives approximate values for the mean and standard deviation of T even where the distributions assumed for its data are accurate. The analytical method gives accurate values of the mean and standard deviation of T provided the assumption of log-normal flows is accurate. Some advantage is obtained by using both methods to check the sensitivity of the results. (Titus-FRC)
W81-01134

AN AUTOMATED SYSTEM FOR MONITORING THE KINETICS OF BIOLOGICAL OXIDATION OF AMMONIA,
Consiglio Nazionale delle Ricerche, Rome (Italy). Inst. for Water Research.
R. Ramadori, A. Rozzi, and V. Tandoi.
Water Research, Vol 14, No 10, p 1555-1557, October, 1980. 2 Fig, 2 Tab, 2 Ref.

Descriptors: *Ammonia, *Chemical reactions, *Sludge treatment, Cultures, Testing procedures, *Nitrification, Time series analysis, Denitrification, Waste treatment, *Oxidation, Microorganisms, Equipment, Volumetric analysis, Spectrophotometry.

A technique is proposed for accurate determination of nitrifiying kinetics in cultures of Nitrosomonas bacteria. The temperature, dissolved oxygen content, ammonium concentration, pH and volume of the sample are established and the rate of nitrification is determined by monitoring the alkali consumption of the sample on a continuous data recorder. Concentrations of volatile suspended solids and ammonia, nitrite, and nitrate nitrogen are determined at the end of the test. The mass of oxidized ammonia is determined by spectrophotometry, by sodium hydroxide consumption, and by a nitrogen mass balance at the beginning and end of the test. The technique produces results in good agreement with conventional methods. It minimizes interpolation errors and avoids interference from other microorganisms. (Titus-FRC)
W81-01135

A REACTION CHAMBER FOR STUDY OF INTERACTIONS BETWEEN SEDIMENTS AND WATER UNDER CONDITIONS OF STATIC OR CONTINUOUS FLOW,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
D. Gunnison, J. M. Brannon, I. Smith, Jr., G. A. Burton, and K. M. Preston.
Water Research, Vol 14, No 10, p 1529-1532, October, 1980. 2 Fig, 2 Tab, 9 Ref

Descriptors: *Sediment-water interfaces, *Lake sediments, *Reservoirs, *Organic loading, *Methodology, Continuous flow, Flooding, Flow, Sediments, Reservoir silting, Sediment distribution, Reservoir operation, Standing waters, Sediment transport, Reservoir construction.

A soil/sediment-water reaction chamber has been designed for use in studies to assess the impact of soil flooding upon the chemical composition of overlying waters. The chamber consists of a plexiglass column fitted with an air-trapping system and with provisions for continuous and variable flow of water, a circulation pump, and sampling ports. The variable flow rate allows a retention period of 17.4 to 347 days for water in the chamber. The chamber has been used in studies of the aging of flooded soil and of effects of organic loading on reservoir water quality. It has potential application to problems of reservoir creation and restoration and for developing rate coefficients for mathematical water quality models. Major advantages of this system are the large volume which minimizes the impact of removal of a large volume of sample, the large sediment-water contact area, and the ability to use the system in either a static or flow-through mode. (Titus-FRC)
W81-01137

THE EFFECT OF CONCENTRATION OF ADSORBING SOLIDS ON THE PARTITION COEFFICIENT,
Manhattan Coll., Bronx, NY. Dept. of Civil Engineering.
D. J. O'Connor, and J. P. Connolly.
Water Research, Vol 14, No 10, p 1517-1523, October, 1980. 7 Fig, 1 Tab, 21 Ref.

Descriptors: *Mathematical studies, *Laboratory tests, *Equilibrium, Hydrologic equations, *Adsorption, *Solids contact processes, Sediments, Soils, Sludge digestion, Heavy metals, Organic compounds, Reaction rates, Pesticide kinetics, Sorption, Soil properties.

Laboratory studies demonstrate an inverse relationship between the concentration of adsorbing solids and the partition coefficient in natural water systems. The partition coefficient is defined as the ratio between the solid-phase and dissolved concentrations, and it is a function of the solubility of the adsorbate and of the organic and clay fractions of the adsorbent. Different compounds adsorbing to the same solids have similar concentration dependences. For example, DDT, heptachlor and dieldrin adsorb to kaolinite, illite and montmorillonite, and cobalt and ruthenium adsorb to Lake Austin sediment at comparable slopes or concentration dependences. This is also true for Dimilin and Kepone adsorbing to Range Point sediment and for heavy metals adsorbing to digested sludge. These relationships have numerous implications to the distribution and retention of heavy metals and organic chemicals in natural water systems. (Titus-FRC)
W81-01144

KINETICS OF TRACE METAL PARTITIONING IN MODEL ANOXIC MARINE SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
S. M. Oakley, C. E. Delphey, K. J. Williamson, and P. O. Nelson.
Water Research, Vol 14, No 8, p 1067-1072, 1980. 6 Fig, 2 Tab, 12 Ref. OWRT A-051-ORE(1).

Descriptors: *Trace elements, *Metals, *Sediments, *Laboratory tests, *Kinetics, Heavy metals, Pollutants, Path of pollutants, Copper, Cadmium, Lead, Zinc, Chemical analysis, Sulfides, Water pollution, Water quality, Marine sediments.

A model anaerobic sediment consisting of humic acid, clay, ferrous sulfide, sand, and seawater was utilized to study the partitioning of Cu, Cd, Pb, and Zn between different geochemical phases. An extraction scheme was developed that was selective for each geochemical phase. Metals were dosed on one phase separately, and then mixed into the other undosed phrases. The kinetics of partitioning were rapid, regardless of which phase was initially dosed; equilibrium was reached within 2-5 days. The stoichiometry of distribution was also independent of the initially dosed phase. The final metal distributions showed that the metal sulfide phase was not necessarily the dominant trace metal sink in anaerobic sediments. (Sims-ISWS)
W81-01154

INTERACTIONS AND SURVIVAL OF ENTERIC VIRUSES IN SOIL MATERIALS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering
M. D. Sobsey, C. H. Dean, M. E. Knuckles, and R. A. Wagner.
Applied and Environmental Microbiology, Vol 40, No 1, p 92-101, July, 1980. 10 Tab, 24 Ref. OWRT-A-090-NC(5), 14-34-0001-6034, 14-34-0001-7070.

Descriptors: *Viruses, *Soils, Earth, Clay loam, Enteric viruses, *Waste water treatment, *Adsorption, Soil materials, Viruses removal, *Soil types, Domestic wastes, Animal wastes(Wildlife), Landfills, Irrigation water.

There were marked differences in the abilities of eight different soil materials to remove and retain viruses from settled sewage, but for each soil material the behavior of two different viruses, poliovirus type 1 and reovirus type 3, was often similar. Virus adsorption to soil materials was rapid, the majority occurring within 15 min. Clayey materials efficiently adsorbed both viruses from waste water over a range of pH and total dissolved solids levels. Sands and organic soil materials were comparatively poor adsorbents, but in some cases their ability to adsorb viruses increased at low pH and with the addition of total dissolved solids or divalent cations. Viruses in suspensions of soil material in settled sewage survived for considerable time periods, despite microbial activity. In some cases virus survival was prolonged in suspensions of soil materials compared to soil-free controls. Although sandy and organic soil materials were poor virus adsorbents when suspended in waste water, they gave > or = 95% virus removal from intermittently applied waste water as unsaturated, 10-cm-deep columns. However, considerable quantities of the retained viruses were washed from the columns by simulated rainfall. Under the same conditions, clayey soil material removed > or = 99.9995% of the viruses from applied waste water, and none were washed from the columns by simulated rainfall.
W81-01171

TRANSLOCATION OF MERCURY AND MICROBIAL ADAPTATION IN A MODEL AQUATIC SYSTEM,
Ohio State Univ., Columbus. Dept. of Microbiology.
J. A. Titus, J. E. Parsons, and R. M. Pfister.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 456-464, September, 1980. 7 Fig, 34 Ref. OWRT-A-042-OHIO(2).

Descriptors: *Mercury, *Bacteria, *Sediments, *Adaptation, Model studies, Metals, Water pollution sources, Water pollution effects, Gastropods, Aquatic life, Fish, Toxins, Resistance, Lakes, Microbiology, Bottom sediments, Laboratory tests, Path of pollutants.

The movement of mercury through components of a 20-gal aquarium model aquatic system and changes in mercury-resistant levels of bacterial populations with increasing sediment mercury load were investigated. Metallic mercury (1 g HgO) was introduced into the mud layer of bed sediments in the model system via a glass tube. In the study of bacterial populations, 0.5 mg Hg(2+)/liter was added daily for 9 wk to the model system, after which it was increased to 5.0 mg Hg(2+)/liter. In less than 7 wk, mercury was found in all test sites of the aquarium. Mercury moved through the sediment with an increasing rate. Levels of mercury in tank water were undetected until the sediment had been traversed. Mercury was accumulated 1,000-fold over levels in tank water in two gastropods. Fish also bioaccumulated mercury. It was thought that the bacterial populations may have been altered in their sensitivity to mercury due to the rapid passage of mercury throughout the bottom sediments. After 5 wk, the mercury content of the sediment reached 0.25 microgram Hg/g. Little change occurred in the total viable count (TVC) at the beginning of the experiment, but a large increase was found in the percentage of the TVC that was resistant to 6 micrograms Hg(2+)/ml at 3 wk. At wk 9, when mercury flow rate was increased to 10 mg Hg(2+)/day, mercury content of sediments rose, while TVC values declined slightly, and percentage of TVC resistant to 6 micrograms Hg(2+)/milliliter rose from about 1% to 10% (falling to 5% after 16 wk). (Geiger-FRC)
W81-01174

WATER-QUALITY MONITORING OF THREE MAJOR TRIBUTARIES TO THE CHESAPEAKE BAY--INTERIM DATA REPORT,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-01184

SUSCEPTIBILITY OF THE MEMPHIS WATER SUPPLY TO CONTAMINATION FROM THE PESTICIDE WASTE DISPOSAL SITE IN NORTHEASTERN HARDEMAN COUNTY, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
D. R. Rima.
Geological Survey Open-File Report 79-750, 1979. 5 p, 1 Fig, 3 Ref.

Descriptors: *Water pollution, *Pesticides, *Waste dumps, *Water supply, *Tennessee, Waste disposal, Leachate, Groundwater movement, Path of pollutants, Water pollution sources, *Hardeman County(TN), Memphis(TN).

Public concern has been expressed over the possibility that leachates from a pesticide waste-disposal site in northeastern Hardeman County, Tennessee, might eventually reach the Memphis area and endanger the city's water supply. An examination of the possible pathways and means of transport of these contaminants reveals that, the Memphis area in detectable concentrations is unlikely. (USGS)
W81-01192

AVAILABILITY AND QUALITY OF GROUNDWATER, SOUTHERN UTE INDIAN RESERVATION, SOUTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
R. E. Brogden, E. C. Hutchinson, and D. E. Hillier.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.75. Geological Survey Water-Supply Paper 1576-J, 1979. 28 p, 4 Fig, 1 Plate, 5 Tab, 11 Ref.

Descriptors: *Groundwater availability, *Water quality, *Water chemistry, *Aquifer characteristics, *Colorado, Hydrogeology, Water wells, Water supply, Water yield, Potable water, Water quality standards, *Southern Ute Indian Reservation(CO).

Population growth and the potential development of subsurface mineral resources have increased the need for good quality groundwater on the Southern Ute Indian Reservation in southwestern Colorado. A study was conducted during 1974-76 to assess the groundwater resources of the reservation. Water occurs in aquifers in the Dakota Sandstone, Mancos Shale, Mesaverde Group, Lewis Shale, Pictured Cliffs Sandstone, Fruitland Formation, Kirtland Shale, Animas and San Jose Formations, and terrace and flood-plain deposits. Well yields from sandstone and shale aquifers are small, generally in the range from 1 to 10 gal/min (gallons per minute), with maximum reported yields of 75 gal/min. Well yields from terrace deposits generally range from 5 to 10 gal/min with maximum yields of 50 gal/min. Well yields from flood-plain deposits are as much as 25 gal/min. Water quality in aquifers depends in part on rock type. Water from sandstone, terrace, and flood-plain aquifers is predominantly a calcium bicarbonate type, whereas water from shale aquifers is predominantly a sodium bicarbonate type. Water from rocks containing interbeds of coal or carbonaceous shales may be either a calcium or sodium sulfate type. Dissolved-solids concentrations of groundwater range from 115 to 7,130 mg/L. Water from bedrock aquifers is the most highly mineralized, while water from terrace and flood-plain aquifers is the least mineralized. In many water samples collected from bedrock, terrace, and flood-plain aquifers, the concentrations of arsenic, chloride, dissolved solids, fluoride, iron, manganese, nitrate, selenium, and sulfate exceeded U.S. Public Health Service (1962) recommended limits for drinking water. Selenium in the ground water in excess of the recommended limit of 10 micrograms per liter for drinking water occurs throughout the reservation but principally in the central part. (USGS)
W81-01197

5C. Effects Of Pollution

THE ROLE OF CORTISOL IN STRESS-INDUCED METABOLIC CHANGES IN FUNDULUS HETEROCLITUS,
Delaware Univ., Newark. School of Life and Health Sciences.
G. J. Leach, and M. H. Taylor.
General and Comparative Endocrinology, Vol 42, p 219-227, 1980. 2 Fig, 2 Tab, 39 Ref. OWRT-A-043-DEL(5).

Descriptors: *Stress analysis, *Metabolism, *Teleosts, *Fish, *Environmental effects, Fish passages, Fish migration, Analysis, Analytical techniques, Strain, Animal metabolism, Proteins, Biochemistry, Aquatic life, Aquatic animals, Fish diseases, Fish behavior, Analyical techniques, Research and development, Testing, Evaluation, Measurement.

Adult Fundulus heteroclitus fish were obtained from salt marsh tidal creeks on the lower Delaware Bay and acclimated to laboratory conditions prior to experimentation. Studies were conducted to determine if the metabolic changes reported earlier for cortisol treatment also occurred in response to endogenous cortisol elevations. Cortisol and relevant metabolic parameters were measured in fish exposed to restraint stress. Metyrapone (MP) treatment was used to isolate metabolic responses specifically attributable to the cortisol elevation. The test fish responded to a number of nonspecific stress stimuli, with transient elevations in serum cortisol levels. MP treatment suppressed stress-stimulated peaks, but did not alter resting cortisol levels. MP also elevated serum '11-deoxycortisol' levels. Fasted fish exposed to restraint stress in a 30 hour stress experiment exhibited marked hyperglycemia, while MP-treated fish exposed to the same stress showed initial hyperglycemia but not the sustained peak seen in untreated fish. Liver glycogen in stressed fish was somewhat higher than in MP-treated stressed fish. No significant changes were noted in stressed fish for muscle glycogen, serum protein, or amino acid content of serum, liver, or muscle. It was concluded that during stress in this species, cortisol appears to act to sustain the elevation in serum glucose. (Zielinski-IPA)
W81-01007

INFLUENCE OF COAL HUMIC ACID ON THE GROWTH OF CHLORELLA VULGARIS ALGAE,
Missouri Univ.-Columbia. Dept. of Chemistry.
S. L. Hoeffner, and S. E. Manahan.
Journal of Environmental Science and Health, Vol A15, No 2, p 149-161, 1980. 2 Fig, 2 Tab, 11 Ref. OWRT-B-145-MO(1).

Descriptors: *Algae, *Chlorella, *Humic acids, *Coals, Water pollution, *Mine acids, *Water pollution effects, Waste water(Pollution), Slurries, Coal mines, Hydraulic mining, Effects, Eutrophication, Research and development, Testing, Assay, Chelation, Chemical reactions, Pollutants, Pollutant identification, Measurement, Evaluation, Estimating.

The effects of coal humic acid leached from coal under coal slurry pipeline conditions and related circumstances on the growth of algae and on potential eutrophication of waters exposed to coal humic substances were studied. Coal humic acid was prepared by partial oxidation of Wyoming subbituminous coal with hydrogen peroxide in a basic medium. Algae (Chlorella vulgaris) were grown in media containing 1.2 mg/liter EDTA, or 75 mg/liter coal humic acid, or in media in which the amount of chelating agent (EDTA) or coal humic acid were varied. At lower levels humic acid was found to stimulate algae growth. Optimum growth was obtained at 75 mg/liter of coal humic acid for algae acclimated to coal humic acid and 55 mg/liter for non-acclimated algae. Low concentrations of EDTA gave erratic results. Growth of algae at very low concentrations of coal humic acid was similar to that seen in the absence of added chelating agent, with the latter cultures often growing faster in later stages of growth. It was suggested that algae excrete a chelating substance that only functions in the absence of added chelating agent. The study indicated that coal humic acid affects algae growth similar to humic acids from more natural sources. (Zielinski-IPA)
W81-01009

CHANGES IN NUTRIENT ION LEVEL OF SUBSTRATES AND STREAM WATER DUE TO LAND MANAGEMENT IN NORTHUMBERLAND,
Northumberland Coll. of Education, Newcastle-upon-Tyne (England). Dept. of Environmental Science.
J. E. Hobrough, and S. Frost.
Environmental Pollution (Series A), Vol 23, No 2, p 81-93, October, 1980. 4 Fig, 4 Tab, 25 Ref.

Descriptors: *Nutrients, *Agricultural watersheds, *Water analysis, Nitrites, Nitrates, Phosphorus, Feed lots, Fertilizers, Water quality, Water pollution sources, Sediments, United Kingdom.

Changes in water chemistry due to watershed land use in Northumberland were attributed to the use of Rumevite feeding licks in sheep pens. The resulting animal droppings and spillage from the licks and feed bags made their way into the streams. Water samples and sediment samples from the streams and the River Pont were analyzed for ammonia, nitrite, nitrate, phosphate, potassium, sodium, calcium, and pH. The streams also received drainage from agricultural lands and

sewage and urban runoff. Comparisons of the chemical composition of substrates and flowing water revealed significant differences in concentration between water and the stream bed. Further biological evaluation is suggested to determine the effects of the pollution on the flora and fauna of the systems. (Small-FRC)
W81-01046

ALGAL AVAILABILITY OF SEDIMENT PHOSPHORUS IN DRAINAGE WATER OF THE BLACK CREEK WATERSHED,
Purdue Univ., Lafayette, IN. Agricultural Experimental Station.
For primary bibliographic entry see Field 5B.
W81-01058

LONG TERM EFFECT OF SEWAGE SLUDGE ADDITIONS ON POPULATIONS OF NOCARDIA ASTEROIDES, MICROMONOSPORA AND THERMOACTINOMYCES IN SOIL,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau.
V. A. Orchard.
Soil Biology and Biochemistry, Vol 12, No 5, p 477-481, 1980. 5 Fig, 21 Ref.

Descriptors: *Sewage sludge, *Environmental effects, *Populations, *Soil fungi, Sludge disposal, Soil microorganisms, Actinomycetes, Landfills, Plant growth, Nutrients, On-site tests, Pathogenic fungi, Public health.

The effects of applications of both wet and dried sludge to soil populations of Nocardia asteroides, Micromonospora spp, and Thermoactinomyces spp were examined in plot experiments. The amount of herbage harvested from the plots over the three year test period was also determined to evaluate the relationship between increased dry matter and sludge decomposition. A sustained zymogenous-like response was observed in Micromonospora when the complex recalcitrant organic substrates that occur in dried sludge were applied to the soil. Wet sludge, which contains less organic material, had no effect on populations of Nocardia and Micromonospora when added to the soil. Contrastingly, greater numbers of Thermoactinomyces were isolated from wet, rather than dry sludge plots. Evaluations of herbage produced during the three year study indicated that plant nutrients were continually mineralized after addition of sewage sludge. (Geiger-FRC)
W81-01061

LAND USE. PIGS IN POKES: PORK BARREL WATER PROJECTS,
League of Women Voters, Rochester, NY.
J. Wellers, and O. Berg.
Environment, Vol 22, No 8, p 5, 42-43, October, 1980. 3 Ref.

Descriptors: *Lakes, *Recreation facilities, *Land use, Legislation, Water pollution, Water resources, Non-consumptive use, Recreation demand, Lake Ontario, Esthetics, New York, Future planning, Canal construction, Environmental effects.

An overview is given of the situation existing between the Army Corps of Engineers and the inland lake, Irondequoit Bay, which is separated from Lake Ontario by a thin natural sand bar. This recreational lake in New York state has long been under consideration as a site for harboring and launching yachts and other craft. The Corps has proposed a project which would build a canal to connect the smaller lake to Lake Ontario by cutting through the sand bar and also construct a bridge over the waterway. Such alterations may endanger the fragile glacial sand slopes that provide aesthetic value to the lake which, at the present, supports only facilities for small boats. Added pollution of lake water from use by larger vessels is also feared, although supporters of the proposed project argue that a mixing of the already polluted lake waters with those of the Great Lakes may help to ease the existing pollution situation. Twenty years of formal discussion on the project have taken place, but special interest groups have always managed to block initiation of the work on the grounds of how the sand bar is to be opened rather than whether or not to open it. Although cost-benefit analyses apparently indicate a profit to local government if the project is executed, local residents still wish to block the construction of the artificial waterway to protect their homes and property. Pure water projects have alleviated problems of high salt deposits in the lake from local pollution. Criticisms of federal actions in such cases as that described for Irondequoit Bay (which is still unsettled) are based on the government's seeming indifference to the consequences of the project on the environment. (Geiger-FRC)
W81-01063

DETRITAL PROCESSING AND ASSOCIATED MACROINVERTEBRATES IN A COLORADO MOUNTAIN STREAM,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
For primary bibliographic entry see Field 5B.
W81-01066

SOME PROBLEMS OF AQUATIC ENVIRONMENTS IN EGYPT FROM A GENERAL VIEWPOINT OF NILE ECOLOGY,
Freshwater Biological Association, Ambleside, (England).
J. F. Talling.
Water Supply and Management, Vol 4, No 1-2, p 13-20, 1980. 59 Ref.

Descriptors: *Nile River, *Reviews, *Aquatic environments, Phytoplankton, River systems, Water pollution, Salinity, Systematics, Lakes, Limnology, Nutrients, Water pollution sources, Path of pollutants, Conductivity, Fluctuations, Egypt.

Some ecological problems of the Nile River are reviewed with a focus on their origin at points upstream. Population sequences obtained by longitudinal surveys in upstream basins could greatly enhance the knowledge of temporal sequences observed downstream. Some examples of combined longitudinal and seasonal surveys from Sudan and Egypt are mentioned. The effects of over-year water storage in Lake Nasser-Nubia upon the periodicity of nutrients, phytoplankton growth and sediment patterns downstream are also considered. More basic limnological studies of Lake Nasser-Nubia are needed to learn more about its nutrients, diurnal changes, populations, and biological and chemical properties. The problems of salinity, nutrient enrichment and pollution effects are addressed in relation to their possible origins from areas upstream. More studies are also needed on changes in chemical and physical properties of the river water. Accurate taxonomic identifications are also vital to studies along the Nile, and some examples of the occurrence of species of the diatom Melosira are included. (Geiger-FRC)
W81-01072

RELATIONSHIP OF POLLUTION TO ROCKY SUBSTRATUM POLYCHAETES ON THE FRENCH MEDITERRANEAN COAST,
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
For primary bibliographic entry see Field 5A.
W81-01099

EFFECTS OF HEAVY METALS IN COMBINATION WITH NTA, HUMIC ACID, AND SUSPENDED SEDIMENT ON NATURAL PHYTOPLANKTON PHOTOSYNTHESIS,
Oslo Univ. (Norway).
D. Hongve, O. K. Skogheim, A. Hindar, and H. Abrahamsen.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 4, p 594-600, October, 1980. 1 Fig, 1 Tab, 20 Ref.

Descriptors: *Water pollution effects, *Metals, Phytoplankton, *Heavy metals, Nitrilotriacetic acid, Pollutants, Water pollution, Lead, Mercury, Cadmium, Copper, Zinc, Aquatic life, Phytotoxicity, Photosynthesis.

The acute effects of copper, cadmium, lead, zinc, and mercury on a natural phytoplankton community were evaluated separately and in combination in Lake Tyrifjorden under different experimental circumstances. The addition of suspended sediment alone to lake water increased photosynthesis about 19%. The four experimental series conducted included natural water + metals; natural water + metals + sediment; natural water + metals + humus; and natural water + metals + NTA (nitrilotriacetic acid). The first experiment indicated that the order of metal toxicity toward natural phytoplankton was: Hg, Cu, Cd, Pb, and Zn, in decreasing order. The effect of heavy metals in water enriched with natural sediment was to reduce the photosynthesis, but the reduction was less than in control water without sediment. The metals, both individually and in combination, inhibited photosynthesis of phytoplankton. The toxicity arising from metal mixtures was an obvious result of synergism. A moderate increase in turbidity of the water reduced biological availability of the metals, thus reducing their inhibitory effect on the rate of photosynthesis. NTA led to detoxification of all tested concentrations of Cu and Cd. Zn and Pb were also detoxified at concentrations less than 10 sup-5M. The metal-NTA complex was more toxic than ionic forms of the metal in the case of mercury. It is noted that the addition of NTA to Lake Tyrifjorden will give directly, without microbiological methylation, a substance which may affect the plankton photosynthesis at a concentration which is only slightly higher than the present concentration of mercury in the lake. (Baker-FRC)
W81-01108

SEASONAL AND SPECIES-DEPENDENT VARIABILITY IN THE BIOLOGICAL IMPACT OF MINE WASTES IN AN ALPINE RIVER,
Alberta Environmental Center, Vegreville.
J. W. Moore.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 4, p 524-529, October, 1980. 1 Fig, 1 Tab, 10 Ref

Descriptors: *Mine wastes, *Algae, *Aquatic life, *Environmental effects, Flat River(Alberta), Water pollution effects, Pollutants, Copper, Cyanide, Invertebrates, Tungsten mine, Insects, Mining, Northwest territories, Alberta.

The effects of mine wastes on aquatic communities varied significantly with species and season. Samples of invertebrates, algae, sediments, and water were collected near a tungsten mine in the Flat River, Canadian Northwest Territory, upstream and at nine stations 0 to 30 kilometers downstream from this area. Analysis of river water showed that concentrations of copper, manganese, beryllium, iron, cobalt, and cyanide increased sharply near the mine compared with control areas. Concentrations of arsenic, lead, zinc, cadmium, and mercury were low throughout the river. Total hardness and pH showed little variation at stations sampled. Heavy metals were generally below detectable limits. Total phosphorus and nitrate concentrations increased at certain stations due to sewage input. The 107 species of algae detected and counted varied inconsistently with location in the river, but were greater near the mine in December. Of 29 species of benthic invertebrates studied, the predominant chironomids were restricted to stations below the mine. Mayflies decreased near the mine. Other species did not show a consistent pattern among the stations. Species composition during December differed considerably from summer populations, invertebrate species densities being higher in December, probably because cold temperatures reduced the toxicity of copper and cyanide. (Cassar-FRC)
W81-01111

COINCIDENCE OF CADMIUM AND ANTIBIOTIC RESISTANCE IN NEW YORK BIGHT APEX BENTHIC MICROORGANISMS,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
For primary bibliographic entry see Field 5B.
W81-01116

REHABILITATION OF THE INNER THAMES ESTUARY,

Thames Water Authority, London (England).
M. J. Andrews, and D. G. Rickard.
Marine Pollution Bulletin, Vol 11, No 11, p 327-331, November, 1980. 6 Fig, 17 Ref.

Descriptors: *Reclamation, *Estuaries, *Fish, Shrimp, Fecundity, Density, Habitat improvement, Ducks, *Thames River, United Kingdom.

The recolonization of the inner Thames estuary during 1976-80 was characterized by increases in population size, animal fecundity, and species diversity. The number of species recorded in the inner estuary increased almost linearly with time until 1976, when all fresh water and euryhaline fish species indigenous to the Thames system had been collected as well as 95% of the marine species prevalent in the southern North Sea. The changing status of many fish species has caused alterations in population structure. Macroinvertebrate studies since 1974 have shown a shift from an assemblage dominated by tubificid worms to a more stable multi-specied community. Organisms recently found included oligochaete worms, polychaete worms, amphipods, isopods, molluscs and crustaceans. Thousands of gravid shrimp and gravid prawn have been observed in the inner Thames. In 1967-70, only one berried shrimp was found among more than 40,000 examined. Algal and waterfowl populations have also recovered to some extent. The influx of organisms beginning in 1964 was related to improved water quality and the return to aerobicity in the summer months following the rebuilding of the Crossness sewage treatment works. The second phase followed the commissioning of extensions to London's other main sewage treatment works at Beckton. (Small-FRC)
W81-01118

CHANGES IN THE ZOOPLANKTON OF ONONDAGA LAKE (NY), 1969-1978,
Syracuse Univ., NY. Dept. of Civil Engineering.
M. A. Meyer, and S. W. Effler.
Environmental Pollution (Series A), Vol 23, No 2, p 131-152, October, 1980. 4 Fig, 10 Tab, 73 Ref.

Descriptors: *Zooplankton, *Lakes, *Eutrophication, *Reclamation, Phytoplankton, Lake stages, Primary productivity, Water pollution effects, New York, Onondaga Lake, Fish, Reviews.

A comprehensive zooplankton study of polluted hypereutrophic Onondaga Lake in New York State was conducted in 1978. Changes in the zooplankton community since an original investigation in 1969 were determined. Re-establishment of the alewife, a size-selective planktivore, probably caused the reduction in large daphnids, in spite of the overall increase in zooplankton biomass and concentration since 1969. The alewife probably had a significant influence, based on the small sizes of dominant microcrustaceans and their probable high turnover rates in such a eutrophic system. The most dramatic change in the lake, the ten- to twenty-fold increase in biomass, may be the result of reclamation efforts which have caused changes in the phytoplankton population. Zooplankton-phytoplankton interactions may delay or resist further reclamation efforts aimed at primary productivity. (Small-FRC)
W81-01122

GAS CHROMATOGRAPHY COMBINED WITH MASS SPECTROMETRY FOR THE IDENTIFICATION OF ORGANIC SULFUR COMPOUNDS IN SHELLFISH AND FISH,
Okayama Univ. (Japan). Dept. of Public Hygiene.
M. Ogata, and Y. Miyake.
Journal of Chromatographic Science, Vol 18, No 11, p 594-605, November, 1980. 12 Fig, 4 Tab, 11 Ref.

Descriptors: *Oil, *Clams, *Mass spectrometry, *Gas chromatography, Laboratory tests, Fish, Analytical techniques, Sulfur compounds, Water pollution effects, Crude oil.

Organic sulfur compounds contained in crude oils can be used as markers of oil pollution in shellfish and fish. Eels and short-necked clams were maintained in the laboratory in water containing crude oil. Mass spectra and mass chromatograms of short-necked clam extract indicated the presence of organic sulfur compounds of alkyl- (C1 to C10) benzothiophenes, dibenzothiophene, alkyl- (C1 to C8) dibenzothiophene, naphthalene, and alkyl- (C1 to C6) naphthalene. Capillary column gas chromatography-mass chromatograms of crude oil and short-necked clam extract indicated the presence of alkyl benzothiophene (C2-C6), dibenzothiophene, and alkyl dibenzothiophene (C1-Cr). A new intensity matching method was devised for the identification of sulfur compounds by capillary gas chromatography/mass spectrometry. (Small-FRC)
W81-01123

PREDATOR-PREY RELATIONS IMPORTANT FOR THE BIOTIC CHANGES IN ACIDIFIED LAKES,
Goeteborg Univ. (Sweden). Dept. of Zoology.
M. O. G. Eriksson, L. Henrikson, B-I. Nilsson, G. Nyman, and H. G. Oscarson.
Ambio, Vol 9, No 5, p 248-249, 1980. 1 Fig, 36 Ref.

Descriptors: *Reviews, *Acidic water, *Lakes, *Predation, Fish, Phytoplankton, Aquatic populations, Distribution patterns, Water pollution effects, Sweden.

A literature review is presented of the altered prey-predator interaction in acidified lakes after the decline or disappearance of fish. When fish were experimentally removed from Lilla Stockelidsvatten, a non-acidified lake, changes in the biotic community were similar to those noted in acidified lakes after the elimination of the fish population. Larger net phytoplankton became more abundant, and small cladocerans were replaced by larger calanids. Small sized, selective predators such as corixids, Chaoborus larvae, and other insects usually preyed on by fish replace fish as the primary predators. Thus, many population structural changes reported in acidified lakes are due to the altered predator-prey interaction. (Small-FRC)
W81-01129

THE AQUATIC VEGETATION OF LLANGORSE LAKE, WALES,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
B. A. Cragg, J. C. Fry, Z. Bacchus, and S. S. Thurley.
Aquatic Botany, Vol 8, No 2, p 187-196, April, 1980. 3 Fig, 1 Tab, 21 Ref.

Descriptors: *Lakes, *Eutrophication, *Aquatic plants, *Turbulence, Surveys, Water pollution effects, Recreation, Vegetation effects, Aquatic populations, Sewage effluents, Nutrients, Aquatic algae, Agricultural runoff, Fertilizers, Mapping, Lake morphometry, Hydrography, *Great Britain, Llangorse Lake(Wales).

A survey was conducted of the aquatic vegetation of Llangorse Lake, which receives treated effluents from the Llangorse Village Sewage Plant and is heavily used for recreational purposes. The status of submerged, emergent, and marginal vegetation was evaluated in this lake, which is situated in the Brecon Beacons National Park in Wales. Results were compared with previous studies on lake flora to assess changes that might have occurred over the years. A marked decline was noted in the diversity of submerged macrophytic flora (dominated by Potamogeton pectinatus and Zannichellia palustris), from eight species in 1973 to only monospecific stands of Z. palustris in 1977. Macrophyte decline was attributed to cultured eutrophication processes along with mechanical disturbances such as boat turbulence. Agricultural runoff contributed many nutrients due to increased use of nitrogenous fertilizers in the catchment area. SYMAP computer mapping was also carried out to produce outlines of the submerged contours. (Geiger-FRC)
W81-01131

ANALYSIS OF THERMAL IMPACT IN TIDAL RIVERS AND ESTUARIES,
Giessen Univ. (Germany, F.R.). Physikalisches Inst.
J. Hauser, D. Eppel, and F. Tanzer.
Water Research, Vol 14, No 10, p 1409-1419, October, 1980. 10 Fig, 7 Ref.

Descriptors: *Temperature, *Model studies, Computer simulation, *Flow, *Turbulence, Velocity, *Tidal streams, Thermal properties, Thermodynamic behavior, Mathematical studies, Estuaries, Poisson rates, Shores.

A mathematical model has been developed to simulate thermal distributions in esturarine areas with severe reversing flow conditions. The model accounts for surface heat transfer, turbulent effects, vertical variations in velocity and temperature, and the three-dimensional geometry of the flow region. Four main algorithms are employed: (1) specification of the boundary, (2) determination of all discrete element midpoints within the solution area, (3) construction of discrete elements of irregular geometry matching the curved boundary, and (4) treatment of boundary conditions and numerical solution of the mathematical system of weakly coupled ordinary differential equations derived from the conservation principles for mass and thermal energy. Preliminary results of the simulation were compared with available data for a section of the Elbe River. Although no quantitative agreement was achieved, comparisons with aerial survey data showed qualitative agreement with the dimensions and behavior of the thermal plume located downstream of the power plant. The model has potential application in predicting thermal plume behavior in power plant designs and in analyses of thermal water pollution. (Titus-FRC)
W81-01142

RECOLONIZATION OF STREAMS BY AQUATIC INSECTS FOLLOWING CHANNELIZATION,
Clemson Univ., SC. Dept. of Entomology and Economic Zoology.
T. R. White, and R. C. Fox.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150252, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Institute, Clemson University, Technical Report 87 (Vol I), May, 1980. 120 p, 17 Fig, 14 Tab, 82 Ref. OWRT-A-037-SC(2), 14-34-0001-9043, 14-34-0001-8043, 14-34-0001-7086, 14-34-0001-6042.

Descriptors: *Channeling, *Streamflow, *Drainage effects, *Aquatic insects, *Sampling, Cores, Laboratory tests, Streams, Channel flow, Channels, Regulation flow, Flow, Channel improvement, Stream stabilization, South Carolina, Aquatic life, Aquatic animals, Insects, Coastal plains, Bodies of water, Regions, Research and development.

Recovery, defined as development of an aquatic insect fauna similar to that of the control streams, does not occur in South Carolina streams following channelization. Five channelized streams and two natural streams were sampled over the 1975-1979 period to determine channelization effects on species composition and diversity of aquatic insects in the Piedmont/Coastal Plain regions. Study of stream samples revealed that channelization yields a fauna composed principally of very tolerant or normally pond inhabitating species. Taxa preferring fast currents, vegetation, and low turbidity were rarely found in the channelized streams. Surber square foot and core samplings afforded greatest utility for characterizing stream aquatic insect diversity; kickscreen sampling was found preferable in determining population composition. The results supported the contention that, if a creek must be altered, it should be by means other than classical channelization for best running water insect faunal preservation. Recommendations to minimize impacts were developed for cases in which a stream must be altered and no alternative exists. (Zielinski-IPA)
W81-01157

THE TRUCKEE BASIN FISHERY, 1844-1944,
Nevada Historical Society, Reno.
J. M. Townley.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150278, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center, University of Nevada, Reno, Desert Research Institute Publication 43008, November, 1980. 88 p, 4 Tab. OWRT-A-096-NEV(1), 14-34-0001-0130.

Descriptors: *History, *Fisheries, *Basins, *Legal aspects, *Water pollution effects, Rivers, Riparian rights, River basin development, Biographies, Planning, Lake fisheries, Stream fisheries, *Nevada, River basins, Institutional constraints, Administration, Water policy, Dams, Bodies of water, Fishing, Water utilization, Legislation, *Truckee River basin(NV).

This second cooperative report of the Nevada Historical Society and the Water Resources Center at the Desert Research Institute builds upon the previous research concerning historical developments in the Truckee River System. A description of the fishery of the Truckee River has been provided from the discovery of the river in 1844 by Fremont, through the next century. Truckee River Fishery importance is evidenced today by litigation and administrative rules that affect the basin water users. The fishery has been discussed in perspective with other historical developments. The chronology of the fishery has been discussed in four principal sections (19th century developments; the Pyramid Lake Fishery before 1900; pulp, paper and pollution; and 1900-1944) using augmentation by 197 footnotes, with predominant references to Nevada statutes and historical issues of the Nevada State Journal and the Reno Evening Gazette. Development of dams and their impacts were discussed, the impacts of industrial pollution and Indian and sport fishing led to trout extinction and decline of the Fishery by 1944. (Zielinski-IPA)
W81-01162

ASIATIC CLAM INVASION: CAUSES AND EFFECTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
D. S. Cherry, J. Cairns, Jr., and R. L. Graney.
Water Spectrum, Vol 12, No 4, p 18-24, Fall, 1980. 8 Fig. OWRT-B-101-VA(3).

Descriptors: *Asiatic clam, Toxicity, Bioassay, Biofouling, *Clams, *Clogging, *Intakes, *Power plants, Water temperature, Corbicula, Bioconcentration, Population, Density, New River(VA).

The introduction and subsequent invasion of the Asiatic clam (Corbicula fluminea) in the United States presents a new problem of infestation in power plant intake systems that conventional intermittent chlorination antifouling procedures may not resolve. This article discusses the dynamics of population increases of this organism and presents a case history at the Glen Lyn power plant in southwestern Virginia, where no clams were found before 1975, followed by a rapid population growth in subsequent years. Potential control measures are described with recommendations for future consequences to the power plant industry.
W81-01173

WATER QUALITY OF THE COLUMBIA RIVER,
Environmental Protection Agency, Seattle, WA. Water Div.
D. L. Petke.
In: Conflicts Over the Columbia River, Seminar conducted by Water Resources Research Institute, Oregon State University, Corvallis, Spring Quarter 1980. Report SEMIN WR 028-80. July 1980. p 65-68.

Descriptors: *Columbia River, *Hydroelectric plants, *Water quality control, *Water temperature, Irrigation water, Return flow, Salmonids, Federal Water Pollution Control Act, Oil spills, Pulp wastes, Bacteria.

The Columbia River has experienced some water quality problems over the years which have limited its use for various purposes. Irrigated agriculture and the construction and operation of multi-purpose and hydro-electric power dams have affected water quality. Industrial development has also produced subtle, long-term water quality changes. In the 1940's and 1950's a significant problem was a slow rise in the overall temperature regimen. The first major problem affecting users was the development of slimes associated with the sheath bacterium Sphaerotilus which coated fishermen's nets and lines. State and federal actions, including the Federal Water Pollution Control Act of 1967 helped solve this problem in the early 1970's. In the 1960's, municipal and industrial waste discharges produced unsafe bacteriological levels; however, this is now controlled, as is a condition known as 'dissolved gas supersaturation' which resulted in losses of 80-90% of downstream migrating salmon. Elevated, almost lethal, water temperatures are still a pervasive problem caused by: (1) dam construction which increases surface area, slows the river flow and produces temperature stratification; (2) point source heat discharges, such as from nuclear power plants; (3) irrigation withdrawals and return flows; and (4) deforestation. To a lesser degree, the water is affected by spills of oil and other hazardous materials. Recent environmental legislation is working toward minimizing these environmental impacts but continued vigilance by the public is also necessary. (Atkins-Omniplan)
W81-01200

5D. Waste Treatment Processes

DESIGN AND SPECIFICATIONS OF A 500 GALLON PER DAY SECONDARY REFRIGERANT FREEZE CONCENTRATION PILOT PLANT TO TREAT AQUEOUS-ORGANIC INDUSTRIAL STREAMS, PHASE 1,
Rohm and Haas Co., Bristol, PA. Engineering Div.
R. W. Carter
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-147837. Final Report to the Office of Water Research and Technology, June 1980. 89 p, 55 Fig, 3 Tab, 2 Ref [illegible] PB81-148566

Descriptors: *Waste water treatment, *Pilot plants, *Organic acids, *Separation techniques, *Freezing, *Engineering, Water purification, Equipment, Design, Model studies, Mechanical engineering, Instrumentation, Technology, Economics, Energy, Costs, Ice, Concentration, Butane.

The complete design specifications for a freeze concentration treatment pilot plant proposed by Rohm and Haas are presented. Freeze concentration purification of waste water by 'freezing out' the fresh water as ice can be more economical than distillation, incineration, or biological treatment. Rohm and Haas chose to investigate the purification of a dilute aqueous stream containing 1.5% acetic acid, 0.5% formaldehyde, and 1.0% other organic acids. The pilot plant is a two-stage, secondary refrigerant, direct contact freezing process with indirect melting and is an energy integrated system. The acetic acid solution is frozen by sparged liquid butane vapor and since acetic acid and water form a simple eutectic, the water freezes out of the solution as pure ice. The ice is separated out and melted using the heat from the condensing butane. The pilot plant was designed to produce 500 gallons per day of fresh water from waste water containing 3% organic waste with a capacity to expand to 750 gallons per day of fresh water from a 50% acetic acid solution. The pilot plant length is 37 feet and the estimated cost of a trimmed pilot plant is $480,981. The materials balance, engineering drawings and instrument specifications, cost estimates, and construction of a scale model have been completed. (Sidney-IPA)
W81-01006

CHEMICAL DOSAGE CONTROL FOR PHOSPHORUS REMOVAL.
Pollutech Pollution Advisory Services Ltd., Oakville (Ontario).
Environmental Protection Service, Ottawa, Ontario, Canada, Training and Technology Transfer Division (Water). Canada-Ontario Agreement on Great Lakes Water Quality Research Report No 4, 1976. 80 p, 43 Fig, 6 Tab, 7 Ref, 3 Append.

Descriptors: *Phosphorus removal, *Waste treatment, *Monitoring procedures, *Chemical dosage controls, Jar-test studies, Full-scale treatment, Data collections, *Great Lakes, Water quality.

This project was undertaken to determine whether a simple monitoring procedure could be utilized to control chemical addition in municipal waste treatment plants. It was intended to demonstrate that proportional control of chemical feeding would be economically advantageous and to determine which specific parameters could be monitored to enable chemical dosage control and at which locations within a treatment plant. A review of all available information on chemical dosage control programs underway in the United States was made, and data from the Ontario Ministry of the Environment based on observations as treatment plants were analysed in detail. No data were found upon which chemical dosages and phosphorus residuals could be compared with other related wastewater parameters. Bench-scale jar studies and measurements at a full-scale plant during chemical addition were therefore conducted to obtain the necessary data. (WATDOC)
W81-01018

REPORT OF THE URBAN DRAINAGE SUBCOMMITTEE PROJECTS CONDUCTED 1972-1978.
Environmental Protection Service, Ottawa (Ontario). Water Training and Technology Transfer Div. Canada-Ontario Agreement on Great Lakes Water Quality Research Report No 101, 1980. 134 p, 3 Append.

Descriptors: *Urban drainage, *Stormwater management, *Chemical treatment, *Phosphorus removal, *Wastewater treatment, Sewage treatment plants, Sewage sludge disposal, Organic contaminants, Toxic substances, Pollution abatement, Storm sewers, Combined sewers, *Great Lakes, Water quality, Projects.

This report of the Urban drainage subcommittee for Great Lakes Water Quality gives 36 detailed project descriptions and summaries. The terms of reference are: to define the magnitude of the pollution due to storm water in the Great Lakes Basin; to establish priorities and schedules for studies directed toward potential solutions to storm water pollution problems; and to develop a strategy for implementing solutions. (WATDOC)
W81-01019

PILOT SCALE EVALUATION OF PHYSICAL-CHEMICAL WASTEWATER TREATMENT SYSTEM FOR COMBINED SEWER OVERFLOWS.
Pollutech Pollution Advisory Services Ltd., Oakville (Ontario).
For primary bibliographic entry see Field 8B.
W81-01020

BORON RECOVERY BY REVERSE OSMOSIS,
Westinghouse Research and Development Center, Pittsburgh, PA.
I. K. Bansal.
Industrial Wastes, Vol 26, No 6, p 12-13, 24, 26, 31, November/December, 1980. 6 Fig, 4 Tab, 1 Ref

Descriptors: *Reverse osmosis, *Nuclear reactors, *Boron, Ion exchange, Waste water treatment, Water purification, Ions, Treatment facilities.

Chemical coagulation, reverse osmosis, and ion exchange processes were evaluated for the removal of contaminants, primarily silica, chloride, calcium, magnesium, and sodium. Up to 67% of the boric acid was recovered from water leaked from the primary loop of an operating nuclear pressurized water reactor system using a combination of reverse osmosis and ion exchange. The volume of contaminating ions was reduced 98%. A proposed system includes filtration, a three stage reverse osmosis membrane system, and final polishing by a single-stage dual bed ion exchange. The final efflu-

ent can be concentrated in a boron evaporator to a level of 4% boric acid. (Small-FRC)
W81-01056

PLATING WASTE TREATMENT,
T. V. Belmont, and J. G. Cunniff.
Industrial Wastes, Vol 26, No 6, p 14, 27, November/December, 1980. 1 Fig, 1 Tab.

Descriptors: *Industrial wastes, *Metals, *Waste water treatment, Copper, Recycling, Treatment facilities, Costs, Metal plating industry, Cyanide.

The waste treatment facilities at the General Metal Finishing Company plant in Attleboro, Massachusetts, are described. Cyanide-bearing rinse waters drain by gravity into a sump after copper, silver, and cyanide reverse cleaners. The rinse waters are mixed in a Cyanide I reaction vessel with various treatment chemicals including 20-25% solutions of sodium hydroxide and hypochlorite. The rinse waters then flow to Cyanide II where the pH is lowered to 7.5-8.5 with sulfuric acid. The clarified effluent is discharged into a sewer. The sludge is disposed of by a licensed waste hauler. The treatment plant cost $208,000 (1978), and the recovery of metals provides an income of approximately $50,000 per year. (Small-FRC)
W81-01057

SEWAGE: WASTE OR RESOURCE,
Wisconsin Univ.-Madison.
C. Hamlin.
Environment, Vol 22, No 8, p 16-20, 38-42, October, 1980. 4 Fig, 27 Ref.

Descriptors: *Sewage treatment, *Sludge disposal, *Recycling, Toxicity, History, Pathogenic bacteria.

While some cities recycle de-watered sludge as fertilizer, there are hygienic and toxicity problems with some sewage wastes. Raw sewage contains pathogenic bacteria, most of which are killed by treatment or exposure to sunlight and air. Industrial wastes add heavy metals and other toxins to sewage, and this threat must be controlled either by eliminating industrial wastes or monitoring plant uptake of the toxins. The problem of rivers polluted by discharged sewage was not solved by any of the early sewage recycling processes such as the ABC method, and the European sewage farms ended with the advent of nitrate fertilizers. Today, knowledge is available for treating sewage, but modern man has forgotten that sewage is a resource and should be returned to the land. (Small-FRC)
W81-01064

DIFFERENT METHODS TO EXTRACT SEWAGE SLUDGE FOR THE CULTIVATION OF CHLORELLA PYRENOIDOSA,
Chinese Univ. of Hong Kong, Shatin. Dept. of Biology.
M. H. Wong.
Archiv fur Hydrobiologie, Vol 88, No 4, p 426-438, June, 1980. 6 Fig, 4 Tab, 25 Ref.

Descriptors: *Separation techniques, *Sewage sludge, *Chlorophyta, Activated sludge, Nutrients, Nitrogen, Phosphates, Aquatic algae, Proteins, Laboratory tests.

Three different techniques were examined for extracting sewage sludge for the purpose of cultivating the unicellular green algae, Chlorella pyrenoidosa. Samples of activated and digested sludge from the Chinese University Sewage Treatment Plant were extracted by submersion into distilled water at 22C for 24 hours, dispersion into distilled water by an electric blender for 20 minutes, or soaking in 0.1 M ammonium acetate for 24 hours at 22C. Extracts obtained from sludge subjected to these three methods were used at 1%, 2%, and 4% concentrations in algal media to test the growth rate of C. pyrenoidosa. Results of cell counts taken at 2-day intervals for 2 weeks showed that only the media containing sludge extracts obtained with ammonium acetate gave poor algae growth. The media made up with sludge extracts obtained from the other two procedures gave algal growth rates similar to that of control media. These findings were attributed to the high NH3-N levels and low pH of the ammonium acetate extracted sludge extracts. Digested sludge extracts had lower levels of macronutrients such as water-soluble phosphate and nitrogen, and therefore yielded algal cells containing a lower protein content than those grown on extracts of activated sludge. (Geiger-FRC)
W81-01069

SLUDGE DEWATERING,
Pierson and Company, Manchester (England).
H. G. W. Pierson.
Water and Waste Treatment, Vol 23, No 9, p 41-42, 44, September, 1980.

Descriptors: *Sludge treatment, *Dewatering, *Drying, Incineration, Waste treatment, Sludge, Filters, Filtration, Screens, Centrifugation.

Considering the cost factor alone, it is usually advantageous to treat sludge on site if it arrives in quantities in excess of 2,000 gallons per week. While it was formerly customary to dewater through incineration whenever possible, increased fuel costs have now restricted this practice to those substances for which it is required by law or for which there is no other possible treatment. The thought that the drier the cake, the lower the overall cost, is criticized. Slightly wet cakes pack much better, and the actual disposal cost is shown to be practically identical whether the cakes are very dry or slightly wet. Types of sludges include colloidal, semi-colloidal, granular, crystalline, fibrous and coarse solids. In most cases it is advantageous to thicken a sludge prior to filtration or separation. Two basic methods for dewatering sludge are filters and gravitaional force. Types of equipment to be considered include filter presses, rotary vacuum drum or rotary vacuum belt filters, gravity belt and compression belt filters, horizontal vacuum belt filters, sock filters, centrifuges or screens. The choice of an effluent filter is extremely important, as important as choosing a proper filter for process slurries. (Baker-FRC)
W81-01071

CONCEPTION OF PLANS FOR A MARSEILLE PURIFYING FACILITY. (CONCEPTION DU PROJET DE LA STATION D'EPURATION DE MARSEILLE),
Inspecteur General des Services Techniques, Marseille (France).
G. Lacroix, M. Duclary, and B. Hoyaux.
Progress in Water Technology, Vol 12, No 4, p 731-755, 1980. 11 Fig, 1 Tab.

Descriptors: *Waste water treatment, *Sewage treatment, *Water treatment, Municipal wastes, Water pollution, Sludge treatment, Marseille(France), France.

Plans for waste water treatment facilities for the city of Marseille, population 1 million, were developed in order to reduce pollution of the Mediterranean Sea. Designers considered the nature of the sea, the influent, the sewage system, the water courses in the area, water and sludge treatment, future sites for treatment plants, and sludge utilization. Following these studies, the city decided to build an underground primary sedimentation water treatment plant in the urban area and a sludge treatment plant outside the city. The plant will be in service in 1983. Costs of construction are estimated at 520 million francs. If periodic studies of the sea indicate the necessity for a second stage treatment facility, this will be considered. (Cassar-FRC)
W81-01078

ADVANCED PRIMARY TREATMENT FOR OCEAN DISCHARGE,
Towill (R. M.) Corp., Honolulu, HI.
S. T. Yamanaka, Jr., O. E. Albertson, and R. Eisman.
Progress in Water Technology, Vol 12, No 4, p 653-683, 1980. 18 Fig, 7 Tab.

Descriptors: *Sewage treatment, *Honolulu, *Sand Island, *Municipal wastes, *Flotation, Waste water treatment, Sludge treatment, Clariflotator, Outlets, Oceans, Sea water, Hawaii, Air flotation, Sludge disposal, Waste treatment, Milan, Illinois, Burlingame(CA), California.

Some cities which face mandatory secondary treatment before discharging their waste water into the ocean are questioning the high costs and the real benefits of this proposed procedure. The paper discusses types of waste and their possible methods of treatment. Details of improved facilities at Sand Island, waste water treatment plant for the City of Honolulu, are given. The key to the Sand Island plant design is an advanced primary treatment stage using six 46 meter diameter flotation-clarifiers to remove light suspended solids and flotables by dissolved air flotation. Heavy materials settle to the bottom of the tank. The outfall, deepest in the world, is 74 meters deep and 4,240 meters long. Detailed operating data for the plant, which started operation in late 1978, are presented. Other flotation-clarification case histories discussed are Milan, Illinois, and Burlingame, California. Sludge handling and disposal methods are discussed. (Cassar-FRC)
W81-01079

NEW CONCEPTS FOR THE TREATMENT OF SEWAGE DISCHARGED TO THE SEA,
Hydrotechnic Corp., New York.
R. Nebolsine.
Progress in Water Technology, Vol 12, No 4, p 639-652, 1980. 5 Fig, 11 Ref.

Descriptors: *Waste water treatment, *Sewage treatment, *Filtration, *Municipal wastes, *Water pollution sources, Coagulation, Effluents, Cleveland, Coasts, Sea water, Contact Coagulation-Ultra High Rate filtration.

The Contact Coagulation-Ultra High Rate filter system is applicable to treatment of sewage before discharge into the sea. Sewage, after passing bar racks, is elevated to pass through rotary screens. After a very short coagulation treatment, the water passes through filters. Effluent is then disinfected with ozone or chlorine, if desired. This process, tested in the city of Cleveland, removed 70% to 80% of suspended solids; 70% to 90% of oils, heavy metals, phosphates, etc.; and 58% to 72% BOD. There are many advantages to the ultra high rate filtration system: it removes many contaminants to the same degree as does secondary treatment at lesser cost, reduces pathogens, occupies 6 to 10% of the area of an equivalent secondary plant, requires 20 minutes total treatment time versus the conventional 5 to 8 hours, requires 0.06 kilowatt hours of energy per cubic meter treated, treats storm runoff easily, occupies an enclosed building, and produces sludge which can be pumped inland for further treatment. Diagrams of plants with capacities of 25, 50, 100, and 200 million gallons per day are provided. (Cassar-FRC)
W81-01080

IMPROVED WASTEWATER TREATMENT FOR HOLIDAY RESORT TOWNS ON THE COAST,
M. E. Garrett, and P. del Rio.
Progress in Water Technology, Vol 12, No 4, p 723-730, 1980.

Descriptors: *Waste water treatment, *Municipal wastes, Sewage treatment, *Oxygen requirements, *Pumping plants, *Resort towns, Coasts, Ozone, Aerobic treatment, Respiration, Water treatment, Megox process, Primox process.

A typical waste water treatment facility for a seaside resort town located near a small river is described. Sewage is oxygenated within the sewer at a pumping station located at the present collection point. Sewage is pumped upgrade, preferably along a river course, to a treatment plant outside of town. After primary settlement, use of filtration, activated sludge treatment, or the Megox process is possible. In the last-mentioned process, oxygenated sludge is recirculated in the lower part of the tank, the upper part acting as a clarifier. The resulting sterile effluent can be transferred through pipes adjoining the river course and be discharged

at sea. A formula for daily oxygen requirements is given. This considers respiration rate, diameter of the main, and sewage retention time in the main. Presence of sulfide requires additional oxygen. The advantages of this process for resort towns are its adaptation to wide fluctuations in population, low capital costs, and prevention of sulfide odor. (Cassar-FRC)
W81-01081

WASTEWATER TREATMENT PROCESS EVALUATED BY FORCE ACCOUNT,
Montana State Univ., Bozeman.
For primary bibliographic entry see Field 6B.
W81-01086

HYDRAULIC EFFICIENCY OF WASTEWATER LAGOON SYSTEMS,
Hazen and Sawyer, Hollywood, FL.
G. W. Bors, and P. E. Robinson.
Tappi, Vol 63, No 11, p 149-151, November, 1980. 6 Fig, 3 Tab.

Descriptors: *Detention reservoirs, *Pulp wastes, Pulp and paper industry, *Waste storage, *Waste water treatment, *Lagoons, Chemical wastes, Industrial wastes, Oxidation lagoons, Stabilization, Activated sludge, Sludge treatment, Waste treatment, Aeration, Ponds, Performance, Efficiencies.

Four case studies of pulp and paper mill waste water lagoon systems illustrate the problem of short-circuiting, which results in reduced hydraulic detention times and decreased treatment efficiency. Corrective measures are described. In each situation time-of-travel and circulation studies were performed using Rhodamine WT dye and a continuous flow cell fluorometer with chart recorder. In the first case, an aerated stabilized basin and oxidation pond system, addition of diversion curtains changed circulation and improved performance. The second system consisted of 6 interconnected natural ponds. Surface baffling was suggested to remedy a temperature stratification condition where the warm waste water remained within the upper 4 feet of the pond. Case 3 was a shallow aerated stabilized basin which demonstrated 72% volume utilization and a 26 hour actual retention time (theoretical, 36 hours). This pond contained several strategically located rotating aeration units. Two additional units were scheduled for installation. The last case, an activated sludge aeration tank, was studied after installation of additional baffles, submerged static mixers, and a return sludge system produced an overall volume utilization of 92%. (Cassar-FRC)
W81-01093

IRRIGATION OF INTENSIVELY CULTURED PLANTATIONS WITH PAPER MILL EFFLUENT,
North Central Forest Experiment Station, Rhinelander, WI.
For primary bibliographic entry see Field 3C.
W81-01094

DIGESTER METHANE UTILIZATION CAN BE OPTIMIZED,
Envirex Inc., Waukesha, WI.
P. G. Baumann.
Water and Sewage Works, Vol 127, No 11, p 44, 45, 66-68, November, 1980. 2 Fig.

Descriptors: *Digestion, *Sludge digestion, *Gas, *Energy conversion, Methane, Heat, Electric power production, Electric generators.

Digester gas, formerly seen as an energy source not worth exploiting, can be used to generate electric power, power boilers to heat sludge and buildings, and run incinerators. Detailed information for a 5 million gallon per day plant is given, with energy balances calculated for electric power generation and digester heat requirements. Suggestions for efficient gas storage and boiler and engine design are described. (Cassar-FRC)
W81-01095

LOS ANGELES, GLENDALE SHARE REUSE PLANT'S PROVISIONS,
Water and Sewage Works, Vol 127, No 11, p 16, 69, November, 1980.

Descriptors: *Water reuse, *Sewage treatment, *Glendale(CA), *Los Angeles, Waste water treatment, Municipal wastes, Sewage treatment, Performance, Sedimentation, Aeration, Filtration, California.

Detailed information on the design and operation of the Los Angeles-Glendale Water Reclamation Plant is presented. This plant, which began functioning May 25, 1976, provides hydraulic relief for the North Outfall Sewer, eliminating an immediate need for increasing sewer capacity, and reclaims waste water for irrigation and industrial use. Capacity of the plant is 20 mgd, annual operation costs are 1 million dollars, and construction costs were 13.6 million dollars. Primary, secondary and tertiary treatments are done. After solid materials are removed by screening and primary sedimentation, activated sludge processing takes place in 6 aeration tanks (240 x 32 x 16 feet) and 10 secondary sedimentation tanks (170 x 20 x 9 feet). Tertiary treatment consists of filtration and chlorination. The city of Glendale uses a major proportion of this processed water for park irrigation and for operation of its steam power plant. (Cassar-FRC)
W81-01096

SOLIDS-CONTACT CLARIFICATION BRINGS OUT BEST OF TRICKLING FILTERS,
Brown and Caldwell, Eugene, OR.
D. F. Norris.
Water & Sewage Works, Vol 127, No 11, p 28, 29, 59, 60, November, 1980. 2 Fig, 2 Tab.

Descriptors: *Waste water treatment, *Sewage treatment, *Solids contact, *Trickling filters, Processes, Sludge treatment, Filtration, Corvallis(OR), Municipal wastes.

The capacity of the Corvallis, Oregon, waste water treatment plant was doubled to 10 mgd by incorporating the trickling filter process with solids contact clarification, replacing the activated sludge process as of January, 1979. This process has about half the energy requirements of the activated sludge method. The key to this process is sludge recirculation and aeration, coupled with new solids-contact clarifiers, which are deeper than the conventional ones and have a center well. Here, mild stirring promotes agglomeration of fast-settling solids. High quality effluent is produced by maintaining circulated solids in an aerobic state for one fifth of the process time. The sludge produced is so dense that it can be wasted directly to the primary sedimentation tanks, where sludge densities are routinely 5.5 to 6.5%. (Cassar-FRC)
W81-01097

ACTIVATED SLUDGE WASTEWATER TREATMENT--STOICHIOMETRIC RELATIONSHIPS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
J. H. Sherrard.
Journal of Chemical Technology and Biotechnology, Vol 30, No 8, p 447-452, August, 1980. 7 Fig, 3 Tab, 6 Ref.

Descriptors: *Activated sludge, *Waste water treatment, *Model studies, *Mathematical models, Sewage treatment, Effluents, Design, Nitrification, Chemical oxygen demand, Oxygen requirements, Alkalinity.

A mathematical model based on kinetic and stoichiometric principles is used to formulate and solve a sample problem in the treatment of activated sludge waste water. This technique can help the engineer to compare treatment alternatives during the design stage and the plant operator to attain maximum efficiency during operation. Graphs illustrate the following relationships as function of mean cell residence time in days: effluent COD and nitrification, daily waste sludge production and oxygen requirements, % carbon distribution, % nitrogen, oxygen uptake per day per pound of activated sludge under aeration, and net change in alkalinity. (Cassar-FRC)
W81-01105

SCREENING AT A FELLMONGERY.
Effluent and Water Treatment Journal, Vol 20, No 9, p 457, September, 1980.

Descriptors: *Effluents, *Water pollution sources, *Screens, Animal wastes, Discharge(Water), *Industrial wastes.

Problems with blockage and choking of effluent drainage lines and pumps at the Retford sheep skin processing plant were solved by the installation of a screen just below ground level. As the effluent cascades into the screen drum the solid fraction is retained inside the drum while the liquid passes through. The effluent drops from the dolly (primary skin cleaning vat) to the screen drum about every 2 hr during the day, at which time the unit handles about 18,000 liters over a 30 min period. The system has been in operation about 7 mo and has overcome most of the problems that had been encountered in processing this difficult effluent. (Baker-FRC)
W81-01107

FLOW EQUALIZE ALL INFLUENT,
Holloway (Max) Engineering Co., Muskogee, OK.
J. Updike.
Water and Wastes Engineering, Vol 17, No 10, p 20-23, October, 1980. 2 Fig, 5 Tab.

Descriptors: *Treatment facilities, *Inflow, *Flow rates, Flow control, *Waste water treatment, Trickling filters, Wet filters, Wet seasons, Basins, Oklahoma, Municipal wastes.

In-line flow equalization basins were installed in the Muskogee, Oklahoma waste water treatment plant to equalize wet weather flows to within existing plant capacity. The plant, a 10 mgd two-stage trickling filter facility, never consistently met NPDES requirements. An infiltration/inflow analysis led to the in-line flow equalization design. The plant passes dry and wet weather flows through the two basins at a preset rate and gains the added benefits of emergency storage capacity and grit removal. The two basins are each 19 ft deep, and have a total usable volume of 35,000,000 gal each. Effluent from the basins is controlled by a 24 inch venturi tube in the return line to the main plant. (Small-FRC)
W81-01119

PHILOSOPHY OF THE SAFE DRINKING WATER ACT AND POTABLE REUSE,
North Carolina Univ. at Chapel Hill.
D. A. Okun.
Environmental Science & Technology, Vol 14, No 11, p 1298-1303, November, 1980. 13 Ref.

Descriptors: *Potable water, *Water reuse, *Legislation, *Public health, Reviews, Waste water, Water utilization, Water treatment, Disinfection, Tertiary treatment, Organic compounds, Water supply, Groundwater, Federal Water Pollution Control Act, Water pollution, Water quality.

A review of the principles of obtaining safe drinking water is presented, along with a historical outline of public health considerations which led to the adoption of these principles. Sanitary surveys mandated by the US Public Health Service in 1962 stressed the identification of sources of pollution and the obtainment of drinking water from the safest possible sources. Prior to the 1962 enactments, little attention was paid to the adequacy of the supply, a factor of major concern to the consumers. While water reuse along rivers increased water supplies, it often caused concentration of pollutants at downstream sites. In the 1800's, relocation of water intake sources in London to sites farther upstream on the River Thames led to reductions in outbreaks of cholera. The use of chemicals for water disinfection in the post-World War II era offered protection against infection from reused water supplies. Reduction of harmful organic compounds in potable water supplies could be achieved by chemical treatment of drawing from unused water sources. Reuse of nonpotable water

was stressed to free potable water supplies from unnecessary contact with man-made pollutants. Problems associated with rendering waste waters potable through technological treatments are many. US government policy stressing research in the treatment of waste water precludes funding for studies of nonpotable water reuse. (Geiger-FRC)
W81-01120

UTILIZATION OF THE WHITE-ROT FUNGUS SPOROTRICHUM PULVERULENTUM FOR WATER PURIFICATION AND PROTEIN PRODUCTION ON MIXED LIGNOCELLULOSIC WASTEWATERS,
Swedish Forest Products Research Lab. Stockholm. Dept. of Chemistry.
M. Ek, and K-E. Eriksson.
Biotechnology and Bioengineering, Vol 22, No 11, p 2273-2284, November, 1980. 3 Tab, 22 Ref.

Descriptors: *Fungi, *Industrial wastes, *Proteins, Industrial water, *Waste water treatment, Laboratory tests, Cellulose, Feeds, Biochemical oxygen demand, Sweden.

A laboratory-scale continuous process that allows a direct conversion of polymeric material into easily harvested fungal protein was developed. This process, which utilizes white-rot fungus Sporotrichum pulverulentum, produces protein and purifies water. Tests on waste water from a fiberboard factory indicated that the degree of water purification is dependent upon residence time. Long residence times cause all carbohydrates and most of the lignin structures to be degraded, but result in low productivity. Production of mycelium for feedstuff requires a holding time of about 15 hr, corresponding to a 60% BOD reduction. If water is recirculated, the 15 hr residence time might be sufficient to keep the content of soluble organic matter at an acceptable level. (Small-FRC)
W81-01126

SAND CAMBISOL FUNCTIONING AS A FILTER THROUGH LONG-TERM IRRIGATION WITH WASTEWATER,
Technische Univ., Berlin (Germany, F.R.).
H-P. Blume, R. Horn, F. Alaily, A. N. Jayakody, and H. Meshref.
Soil Science, Vol 130, No 4, p 186-192, October, 1980. 6 Fig, 3 Tab, 8 Ref.

Descriptors: *Waste water disposal, *Cycling nutrients, *Filtration, Forests, Nutrients, Irrigation, Forest soils, Dynamics, Drainage, Environmental effects, Flooding, Leaching, Estimating equations, Rainfall, Air pollution, Soil horizons.

Waste water disposal by irrigation onto arable land provides water purification before the water is returned to the natural reservoirs and recycling of nutrients. Comparisons were made of a cambisol supplied with waste water since 1900 and a similar soil from under a pine forest with no application of waste water. Parameters examined in each soil were total porosity, pore size distribution, hydraulic conductivity, nitrogen forms, exchangeable ions, and heavy metals. No great differences were noted in texture and bulk density of the two soils. Long-term waste water irrigation of the cambisol caused a slightly increased organic content as well as higher levels of phosphorus and nitrogen. Copper and zinc were also highly retained by the cambisol when compared to the forest soil. Manganese and zinc were lost in the subsoil of the cambisol due to low oxidation potentials. Both sites underwent changes in elemental content due to intense air pollution and the effects of rainfall. Changes in soil content of elements were calculated by a mathematical formula based on soil horizon data. The dynamics of flooding and drainage at the two sites and their effects on soil composition were also investigated. Results of these studies indicate sharp reductions in the filtering of iron and manganese nutrients. (Geiger-FRC)
W81-01130

STORAGE-INDUCED DENITRIFICATION USING SEQUENCING BATCH REACTOR OPERATION,
Maryland Univ., College Park. Dept. of Civil Engineering.
J. E. Alleman, and R. L. Irvine.
Water Research, Vol 14, No 10, p 1483-1488, October, 1980. 5 Fig, 1 Tab, 13 Ref.

Descriptors: *Denitrification, *Wastewater treatment, *Organic compounds, *Carbon, *Bacteria, Nitrogen, Design criteria, Sewage bacteria, Nitrite, Nitrification.

Bacterial storage may substitute for raw-waste organic carbon components as the electron-donor substrate required for denitrification. Bench-scale studies of storage induced denitrification were conducted using a sequencing batch reactor. By operating the reactor in a mode conducive to the development of cellular storage, the system maintained a consistent 92% or greater reduction in total nitrogen without a carbon supplement. Depletion of the cellular glycogen reserve was observed during the denitrification reaction. This system has potential application to advanced wastewater treatment. It suggests that denitrification can be maintained solely on the basis of endogenous activity. (Titus-FRC)
W81-01132

ENHANCEMENT OF PCBS BIODEGRADATION BY SODIUM LIGNINSULFONATE,
National Water Research Inst. Burlington (Ontario).
D. Liu.
Water Research, Vol 14, No 10, p 1467-1475, October, 1980. 7 Fig, 12 Ref.

Descriptors: *Biodegradation, *Bacteria, *Gas chromatography, Cultures, Water analysis, *Polychlorinated biphenyls, Surfaces, Growth rates, Oxidation, Microbial degradation, Chlorination, Boundary processes.

Microscopic examinations and growth studies indicate that biodegradation of commercial PCBs is enhanced by the use of sodium ligninsulfonate in the culture medium of Pseudomonas bacteria. Sodium ligninsulfonate stimulates the bacterial growth rate and biodegrades without being used itself. It thus allows cells to overcome the substrate limiting factor of surface area. Analyses of the culture broth by gas chromatography revealed that the bacteria could degrade 300 parts per million of Aroclor 1254 after 18 days incubation. Manometric data demonstrate that lower chlorinated PCBs are oxidized faster than higher chlorinated PCBs. Commercial preparations of PCBs are mixtures of many different isomers with varying chlorine content. The properties of these mixtures are vastly different and complex to study. Since PCBs are among the most persistent lipophilic substances found environmentally, the significance of interface control on biodegradation rates has potential application for other lipophilic compounds in the aquatic environment. (Titus-FRC)
W81-01133

ULTRAFILTRATION PROCESSES FOR POLLUTION CONTROL AND CHEMICAL REUSE IN THE TANNING INDUSTRY,
Naples Univ. (Italy). Facolta di Ingegneria.
E. Drioli, and B. Cortese.
Desalination, Vol 34, No 1/2, p 131-139, July/August, 1980. 3 Fig, 5 Tab, 3 Ref.

Descriptors: *Filtration, *Waste water treatment, *Industrial wastes, Pilot plants, Reclaimed use, Water reuse, Effluents, *Water quality control, Methodoloy, Organic compounds, Recirculated water, Recycling.

Experiments were conducted to determine the effectiveness of ultrafiltration in treatment of tannery wastes. Dehairing and degreasing produce the most highly polluting wastes of the tanning process. Effluents contain high levels of sulfur, amines, mercaptans and sludges from skin and hair. Noncellulosic membranes able to function in the pH range from 2 to 13 and at temperatures up to 50C were used in two pilot ultrafiltration plants. Experiments were conducted using tubular membranes, continuous recycling and continuous feeding of waste water, and pressures of 3.2 atmospheres and 3.0 atmospheres. Results show a decrease in the selectivity of the membrane toward grease removal with increasing temperature, accompanied by increased permeation flow. In the experiments in which the concentrated solution was continuously recycled, the flux decline was rapid, dropping from 150 liters per hour to 10 liters per hour in 3 hours. Ultrafiltration of dehairing effluents produced a near zero rejection towards electrolytic species and produced a high rejection towards proteinaceous and colloidal substances. The simplicity of ultrafiltration and the possibility of controlling the concentration of the chemical species in the permeate by varying membrane type and process conditions make this method competitive with other conventional methods. (Titus-FRC)
W81-01139

RESIDENCE TIME DISTRIBUTION IN SUBMERGED BIOFILTERS,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
M. Riemer, G. Holm Kristensen, and P. Harremoes.
Water Research, Vol 14, No 8, p 949-958, August, 1980. 12 Fig, 3 Tab, 12 Ref.

Descriptors: *Model studies, *Denitrification, *Biological membranes, *Filters, Mathematical studies, Biological treatment, Tracers, Bubbling, Nitrogen, Adsorption, Nitrates, Kinetics.

When kinetic models for chemical or biological reactions are evaluated the residence time distributions are often utilized. Often results from tests on submerged biological denitrification filters deviate systematically from those expected for the simple flow models by exhibiting pronounced tailing. Tailing also makes the estimation of the Peclet number from the variance of the response curve very difficult or impossible. A mathematical model is presented in which the head of the distribution results from the usual longitudinal dispersion in a porous medium. In this system a group of pulse response curves consisting of a leading head are generated (almost Gaussian) and are followed by a tail with exponential decay. The characteristics of the model curves were identical to those formulated under experimental conditions. Tests with a dye tracer showed marked adsorption effects. The tracer was useful in monitoring over-all performances of submerged filters and determining the longitudinal dispersion and volume occupied by biofilm and bubbles. Non-bubbling trials using tritium as tracer gave little deviation between pulse and step-down experiments with regard to tailing due to irregular biofilm morphology. When significant sections of the surface are bared by nitrogen bubbling, the degree of coverage and mean biofilm thickness cannot be estimated with great certainty. (Geiger-FRC)
W81-01140

THE THERMAL SENSITIVITY OF NITRIFICATION AS A FUNCTION OF THE CONCENTRATION OF NITROGEN SUBSTRATE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
A. V. Quinlan.
Water Research, Vol 14, No 10, p 1501-1507, October, 1980. 5 Fig, 2 Tab, 31 Ref.

Descriptors: *Thermal properties, *Oxidation, Nitrite, *Mathematical studies, Nitrogen, *Nitrification, Ammonia, *Bacteria, Temperature, Chemical reactions, Microorganisms, Waste treatment, Chemical degradation.

The joint influence of substrate concentration and temperature on bacterially mediated ammonia and nitrite oxidation is analyzed using rate laws from the literature. Results demonstrate that optimum temperature relations offer a means for controlling thermally induced accumulations of nitrites in nitrifying systems whose temperatures can be manipulated. This has potential application in small sewage treatment plants, cooling towers and ponds. At present temperature control is practiced in several industrial wastewater treatment plants, but is not economically feasible in most domestic

wastewater treatment plants because of the large flows involved. Thermal enrichment of nitrifying systems poses a severe ecotoxicological hazard, because nitrites at concentrations as low as .5 parts per million are carcinogenic and anoxogenic and because concentrations increase substantially as temperature increases. (Titus-FRC)
W81-01145

COMMENT,
Proctor and Gamble Ltd., Newcastle-upon-Tyne (England).
A. P. Walker, W. F. Holman, and R. H. Wendt.
Water Research, Vol 14, No 1, p 95-101, January, 1980. 15 Ref.

Descriptors: *Sludge treatment, *Heavy metals, *Water pollution sources, *Laboratory tests, *On-site investigations, Publications, Suspended solids, Detergents, Chemical wastes, Sewage treatment, Biodegradation, Water properties, Water quality.

Comments concerning the findings of Stoveland et al (1979) on the laboratory removal of nitrilotriacetate from artificial sewage are presented. A review of the scientific literature establishes that nitrilotriacetate is effectively removed during sewage treatment over a wide range of conditions, including soft water, and that it does not cause increased metal pollution of receiving waters. Under laboratory conditions, nitrilotriacetate can solubilize metals. However, under practical conditions, concentrations of cadmium, nickel and mercury in domestic wastewater are low, the aerobic biological wastewater treatment systems are capable of removal rates greater than 90%, and nitrilotriacetate concentrations in effluent are insignificant. It is suggested that the laboratory results of Stoveland et al. omitted data on suspended solids which are significant in heavy metal removal and that the laboratory conditions are not comparable to municipal conditions. Statistical evaluations were also absent. Nitrilotriacetate has practical application as a detergent builder. (Titus-FRC)
W81-01146

RESPONSE TO COMMENTS BY A. P. WALKER, W. F. HOLMAN AND R. H. WENDT,
Imperial Coll. of Science and Technology, London (England). Dept. of Public Health Engineering.
S. Stoveland, J. N. Lester, and R. Perry.
Water Research, Vol 14, No 1, p 103-107, January, 1980.

Descriptors: *Sewage treatment, *Detergents, *On-site investigations, *Laboratory tests, Biodegradation, Publications, Heavy metals, Sludge treatment, Suspended solids, Chemical wastes, Water properties, Water quality.

Use of nitrilotriacetic acid as a detergent builder may have adverse influence on metal removal during biological waste water treatment in some European areas. Where high population density and intense industrial activity occur together, large quantities of detergent builder in domestic waste water and significant concentrations of heavy metals from industrial and domestic sources may be combined. Water reuse may also be practiced. Under such conditions, nitrilotriacetric acid may diminish metal removal in waste water treatment. Most scientific literature on this subject is from Canada, where the low nitrilotriacetic acid concentrations in effluent may be attributable to great dilutions by the abundant receiving waters. Laboratory simulations of conditions in European population centers can be resolved by research which is now in progress using pilot scale equipment treating real sewage. (Titus-FRC)
W81-01147

EFFECT OF ALCOHOLS ON THE MECHANICAL AND TRANSPORT PROPERTIES OF ASYMMETRIC CELLULOSE ACETATE MEMBRANES,
Naples Univ. (Italy). Ist. di Principi di Ingegneria Chimica.
F. Alfani, E. Drioli, and L. Nicolais.
Water Research, Vol 14, No 5, p 461-466, May, 1980. 7 Fig, 2 Tab, 11 Ref.

Descriptors: *Membrane processes, *Alcohols, Membranes, Separation techniques, Organic compounds, Mass transfer, Reverse osmosis, Treatment, *Waste water treatment, Strength of materials, Tensile strength.

One problem in the use of reverse osmosis (RO) for waste water treatment is the choice of a proper membrane, since the interaction with organic compounds and therefore membrane selectivity is strongly dependent on membrane structure. The interaction between solute and membrane was analyzed in the presence of various alcohol solutions using a combined analysis of tensile properties and rejection performance of different RO membranes. The findings indicate that commercial cellulose acetate membranes may be used in ultrafiltration processes to recover alcohols from the water. The analysis of stress-strain curves of virgin membranes conditioned in alcohol solution can assess the potentiality of the cellulose acetate membrane in the alcohol recovery process. (Baker-FRC)
W81-01148

A CORRELATION METHOD FOR THE ESTIMATION OF RETENTION TIMES AT FULL-SCALE SEWAGE TREATMENT PLANTS,
University of Strathclyde, Glasgow (Scotland) Dept. of Applied Physics.
J. M. Crowther, J. F. Dalrymple, and T. Woodhead.
Water Research, Vol 14, No 6, p 567-574, June, 1980. 6 Fig, 3 Tab, 16 Ref.

Descriptors: *Retention, *Sewage treatment, *Biochemical oxygen demand, *Suspended solids, *Correlation analysis, Indicators, Tracking techniques, Theoretical analysis, Flow rate, Variability, Statistical methods, Water analysis, Dye releases, Path of pollutants, Hydraulics, Settling basins, Sediments, Evaluation.

An alternative method for measuring retention time is described. Estimates of retention time are derived by applying correlation analysis to flow rates. The method yields an average retention time, and thus provides information on the average hydraulic performance of the unit. Diurnal and random variations in influent biochemical oxygen demand and suspended solids are used as time-varying tracers. Three time series experiements were conducted using biochemical oxygen demand results taken from samples at varying flow rates. Correlation analysis was performed, uncertainties in periods and retention times were calculated, and influent and primary tank biochemical oxygen demands were cross-correlated. Results show no clear dependence on flow rates. Discrepancies in results between correlation estimates and flow-based estimates suggest that approximately 50% of the sedimentation tank volume is not exploited by the flow and represents a dead volume. (Titus-FRC)
W81-01150

EXPERIMENTAL ASSESSMENT OF HALOFORM REACTION PRECURSORS (ETUDE D'UNE METHODE D'EVALUATION GLOBALE DES PRECURSEURS DE LA REACTION HALOFORME),
Poitiers Univ. (France). Lab. de Chimie XI.
M. Dore, and J. Goichon.
Water Research, Vol 14, No 6, p 657-663, June, 1980. 6 Fig, 1 Tab, 11 Ref.

Descriptors: *Chlorination, *Water purification, *Spectrophotometry, *Chemical analysis, Iodine, Halogens, Chemical reactions, Chlorine, Analytical techniques, Ammonia, Haloforms, Haloform precursors.

A method for evaluating haloform reaction precursors is explained. The principle of the analysis is based on the action of iodine on the precursors and on the measurement of the amount of iodoform obtained by spectrophotometry in the utra-violet band. The reaction parameters (conditions of pH and of extraction, time of reaction) were studied to produce a simple analytical method of operating, presenting both precision and sensitivity. Iodine constitutes an interesting reagent for this measurement because it is not consumed by ammonia and it displays four characteristic bands in the ultra-violet range. The reaction gives good results with ketonic precursors; however, with metapolyhydroxybenzenes, results are inferior to those obtained by chlorination. (Titus-FRC)
W81-01151

LOS ANGELES TO MEET REGS WITH ENERGY-MISER SLUDGE PROCESSOR,
D. C. Tillman.
Water and Sewage Works, Vol 127, No 11, p 30-32, 62, November, 1980. 3 Fig.

Descriptors: *Sludge disposal, *Los Angeles, *Hyperion plant, *Sludge treatment, *Ultimate disposal, Municipal wastes, Waste water treatment, Waste disposal, Thermal sludge disposal, Electric power production.

To comply with directives prohibiting disposal of sewage sludge in Santa Monica Bay, the city of Los Angeles chose a sludge treatment method which produces energy from gases formed during digestion. The Hyperion Plant, which will be fully operational by 1985, will be capable of processing 264 tons per day (dry basis) using the thermal sludge disposal system. The process not only provides energy for evaporation of sludge water and for thermal destruction of solids by pyrolysis, it produces a surplus of 200,000 kilowatt hours of electricity per day. The thermal disposal system has several advantages over conventional sludge disposal systems: low energy requirements, greatly reduced amount of solids handled, an essentially sterile sludge, 99+% solids removal, and an effluent closely approaching distilled water. (Cassar-FRC)
W81-01152

PACKED BED FILTRATION: EXPERIMENTAL INVESTIGATION AND CONCEPTUAL ANALYSIS OF FILTER RIPENING MODEL,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. E. Tobiason.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-151961. Price codes: A07 in paper copy, A01 in microfiche. MS Thesis, 1979. 136 p, 30 Fig. OWRT-A-104-NC(1), 14-34-0001-9035.

Descriptors: Filtering systems, Packed beds, *Water treatment, *Filters, *Waste water treatment, Filtration, *Separation techniques, Evaluation, Packed beds, Suspended solids, Particle size, Liquid-solids separation, Filter ripening model.

A theory for filter ripening (Ali, 1977) is subjected to experimental and conceptual analysis in order to test its applicability under conditions much different than those for which it was calibrated and verified. The filtration theory incorporates physical and chemical characteristics of the entire filtration system in predicting the removal of suspended solids and the development of head loss throughout a filter run. Filtration performance is a function of filter variables (bed depth, porosity, filtration velocity, media size and type) and suspension variables (solids concentration, temperature, particle size and type). The chemistry of the system (ionic strength, polymer type and dose) also controls filter performance and is included in the theory. Experiements are conducted by filtering suspensions of Min-U-Sil particles at two different size ranges at two concentrations and flow rates through pilot filters. Four identical filter columns, each containing different sized media, are used in each experiment. Solids removal efficiency is evaluated by measuring the light scattering of influent and effluent samples. Head loss is determined from open manometers connected to the filter columns. The experimental results are compared to predictions obtained from the theory for filter ripening. In general, the effects of variations in collector size, suspended solids concentration, flow rate and particle size on filter performance are modeled correctly, but exact fits using consistent values for model coefficients are not obtained. Removal efficiency is modeled well but head loss predictions are not generally in agreement with the expeimen-

tal results. Conceptual considerations yield possible explanations for these discrepancies.
W81-01168

TREATMENT OF DILUTE METAL EFFLUENTS IN AN ELECTROLYTIC PRECIPITATOR,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Chemical Engineering.
A. W. Bryson, and K. A. Dardis.
Water SA, Vol 6, No 2, p 85-87, April, 1980. 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Industrial wastes, *Metals, *Effluents, *Waste water treatment, *Electroplating, Electrodes, Nickel, Chromium, Copper, Zinc.

The presence of metals in industrial effluents may cause problems during sewage treatment processes which use bacterial action to digest sludge. A test plant was constructed to remove these metals from dilute solutions by electrolytic precipitation using a particulate bed electrode cell. A fixed-bed cell (1900 mm x 350 mm x 5 mm) containing crushed graphite of a particle size of 1.2 mm to 1.7 mm was able to reduce the concentrations of nickel, chromium, copper, and zinc in electroplating works effluent water from 16.2-37.5 mg per liter to 1.5 mg per liter or less. Current ranged from 20 to 40 amperes; voltage ranged from 3.0 to 5.4 volts; and the flow rate was 180 liters per hour for nickel and chromium and 360 liters per hour for copper and zinc. (Cassar-FRC)
W81-01172

5E. Ultimate Disposal Of Wastes

CHEMICAL DOSAGE CONTROL FOR PHOSPHORUS REMOVAL.
Pollutech Pollution Advisory Services Ltd., Oakville (Ontario).
For primary bibliographic entry see Field 5D.
W81-01018

LONG TERM EFFECT OF SEWAGE SLUDGE ADDITIONS ON POPULATIONS OF NOCARDIA ASTEROIDES, MICROMONOSPORA AND THERMOACTINOMYCES IN SOIL,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau.
For primary bibliographic entry see Field 5C.
W81-01061

SEWAGE: WASTE OR RESOURCE,
Wisconsin Univ.-Madison.
For primary bibliographic entry see Field 5D.
W81-01064

APPLICATION OF SEWAGE EFFLUENT TO COLUMNS OF A MOUNTAIN MEADOW SOIL: I. ERRORS IN CALCULATING THE TRANSPORT OF IONIC SALTS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 3C.
W81-01090

METAL UPTAKE BY CROPS GROWN OVER ENTRENCHED SEWAGE SLUDGE,
Science and Education Administration, Beltsville, MD. Biological Waste Management and Organic Resources Lab.
L. J. Sikora, R. L. Chaney, N. H. Frankos, and C. M. Murray.
Journal of Agricultural and Food Chemistry, Vol 28, No 6, p 1281-1285, November/December, 1980. 4 Tab, 22 Ref.

Descriptors: *Sludge disposal, *Crop response, *Metals, *Waste disposal, *Sewage sludge, Municipal wastes, Lime, Disposal, Oats, Wheat, Chard, Entrenchment, Ultimate disposal, Waste water treatment, Landfills, Agriculture.

Oats, wheat, and chard were grown on plots containing entrenched sewage sludge from the Blue Plains waste water treatment plant, Washington, D.C. Two forms of sludge were used, digested and raw limed, in a study of metal uptake by crops. Lime was applied to half the digested and half the control plots to determine the influence of pH on metal uptake. Chard accumulated higher metal levels than either wheat or oats. Absorption of metals by plants grown over sludge was greatest using unlimed digested sewage (pH 5.4). Liming these plots reduced metal uptake slightly. Plants absorbed metals from limed raw sludge plots (pH 6.7) to an equal or lesser degree than in control plots. These results suggested that agricultural crops may be grown over entrenched sludges (raw or digested) if the sludge is low in heavy metal content. (Cassar-FRC)
W81-01100

5F. Water Treatment and Quality Alteration

ELECTRON MICROSCOPY OF GIARDIA LAMBLIA CYSTS,
Washington Univ., Seattle, Dept. of Environmental Health.
D. L. Luchtel, W. P. Lawrence, and F. B. DeWalle.
Applied and Environmental Microbiology, Vol 40, No 4, p 821-832, October, 1980. 19 Fig, 23 Ref.

Descriptors: *Protozoa, *Water purification, *Filters, Public health, Filtration, Potable water, Water pollution, Electron microscopy, Separation techniques, Coagulation, Water pollution treatment, Human diseases, Pilot plants, Membranes.

Current outbreaks of giardiasis have been associated with exposure to Giardia lamblia in municipalities that use inadequately-treated surface water for drinking water. Methods of coagulation and dual media filtration to treat water to remove the G. lamblia cysts were investigated in pilot plant studies. Electron microscopic studies of cysts collected on 5.0 micrometerporosity membrane filters were also conducted. G. lamblia cysts isolated from fecal samples from human giardiasis patients and other fecal material were diluted in distilled water to known concentrations, and the dilutions were used to spike pilot plant water supplies. In addition to the 5.0 micrometer Nuclepore membrane, Millipore filters of 5.0 micrometer-pore size were evaluated to increase filtration efficiency. Results showed a greater percent recovery on the Nuclepore filter as opposed to the Millipore filters. Electron microscopic studies of cyst walls showed different patterns of distortion between G. lamblia cysts collected on Nuclepore and on Millipore filters. The implications of cyst distortion on filters for the purification of raw water samples are discussed. (Geiger-FRC)
W81-01059

LOW-COST FILTER SYSTEM MEETS DRINKING WATER STANDARDS,
CH2M/Hill, Redding CA.
R. L. Chapman, and G. R. Benoit.
Public Works, Vol 111, No 9, p 102-104, September, 1980. 1 Fig, 2 Tab.

Descriptors: Turbidity, *Filtration, *Water treatment, *Sacramento River, *Bella Vista Water District(CA), Water quality, Rivers, Pilot plants, Alum, Costs, Annual costs, Capital costs, *Potable water, Standards.

Increasing domestic and irrigation water demand in the Bella Vista Water District, Redding, California, approached the capacity of well sources and required the use of Sacramento River water with objectionable turbidity above 1.0 at minimal added cost. In 1976 pilot plant studies were begun on a low-cost, direct high pressure filtration system. The major objective was to determine the filterability of the Sacramento River water under different turbidity conditions. Construction of the full-scale treatment plant was completed in summer 1978 at a total cost of 6.47 million dollars. Two years operation of this system has proved that the fundamental design is good and that operation and maintenance costs are low. During 1979, 3,428 million gallons of water were treated at a cost of $9.77 per million gallons. Filtered water turbidities averaged less than 0.5 unit, and raw water turbidities ranged from 15 in winter to 1.9 in summer. Studies at higher filtration rates indicated that 6.5 million gallons per day (turbidity 0.2 - 0.4 unit) was produced at the end of a 10 hour test from raw water with 9.5 turbidity. (Cassar-FRC)
W81-01084

CORROSIVENESS OF DRINKING WATER AND CARDIOVASCULAR DISEASE MORTALITY,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands).
B. J. A. Haring, and B. C. J. Zoeteman.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 4, p 658-662, October, 1980. 4 Tab, 10 Ref.

Descriptors: *Hardness(Water), *Human diseases, *Potable water, Hydrogen ion concentration, Epidemiology, Mortality, The Netherlands.

Many epidemiologists have reported that hard water is statistically correlated with low death rate from cardiovascular diseases. A sampling program was carried out in The Netherlands among 28 water supplies to measure pH and water hardness of the drinking water. The pH values were determined, since higher pH values are generally associated with lower metal solvency. A significant negative correlation was found between hardness and pH for the water supplies tested. A possible explanation for these results is that at present most waterworks condition the water in such a way that drinking water is saturated with respect to CaCO3. Also, the saturation pH of hard drinking water is usually lower than that of soft water. The intake of lead and other inorganic constituents was investigated in a proportional sampling study of 50 households with lead piping in each of 20 cities in the Netherlands. The release of lead and copper from metal household water distribution pipes was positively correlated with calcium content. The softer water had higher pH values and lower levels of lead and other metals, in general. (Small-FRC)
W81-01109

COLOUR AND TURBIDITY REMOVAL WITH REUSABLE MAGNETIC PARTICLES-II. COAGULATION WITH MAGNETIC POLYMER COMPOSITES,
Commonwealth Scientific and Industrial Research Organization, South Melbourne (Australia). Div. of Chemical Technology.
N. J. Anderson, B. A. Bolto, R. J. Eldridge, L. O. Kolarik, and E. A. Swinton.
Water Research, Vol 14, No 8, p 967-973, August, 1980. 2 Fig, 10 Tab, 4 Ref.

Descriptors: *Color, *Turbidity, *Flocculation, *Iron oxides, Separation techniques, Settling velocity, Polymers, Resins, Aquatic algae, Water treatment, Water purification, Surface water, Cation exchange, Magnetism.

The coagulation of a turbid, colored river water was enhanced by composite particles containing magnetic iron oxides in polyvinyl alcohol matrix. The removal of turbidity at a given alum dose was increased by uncharged magnetic particles. Desired levels of turbidity were removed at lower doses of alum. When alum plus magnetic iron oxides were used, the rates of floc formation and settling were doubled. The effectiveness of coagulation was increased by grafting linear polymers to magnetic polymers, and the uncharged particles could be reused after rinsing with water. When alum was used with magnetic particles which were grafted with chains of cationic polymers, rapid settling, coagulation of algae, and removal of color and turbidity were achieved. Regeneration of grafted particles was accomplished by addition of brine. Although incomplete regeneration occurred when the cationic magnetic particles were used without alum, good turbidity and color removal from river water were obtained. (Geiger-FRC)
W81-01141

CHLORINE DISAPPEARANCE IN SEA WATER,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
D. Midgley.
Water Research, Vol 14, No 10, p 1559-1560, October, 1980.

Descriptors: *Chlorine, *Bromine, Chemical reactions, *Water chemistry, *Sea water, *Cooling water, Salinity, Ionization, Acid-base equilibrium, Solubility, Chemistry, Catalysts, Water properties, Saline water, Power system operation.

An explanation for chlorine disappearance in sea water is proposed. The oxidation of bromide in seawater produces hypobromite and hypochlorite. In such mixtures, chlorate formation is catalyzed by hypobromous acid. Experiments at carefully controlled pH are needed to confirm the explanation and estimated decay rate. Digestion with concentrated hydrochloric acid under inert atmosphere is recommended for future experimentation. The practical importance of chlorine disappearance in power station cooling waters is questioned. (Titus-FRC)
W81-01143

WASTEWATER CHARACTERIZATION IN A MULTIPRODUCT DAIRY,
North Carolina State Univ., at Raleigh.
R. E. Carawan, V. A. Jones, and A. P. Hansen.
Journal of Dairy Science, Vol 62, No 8, p 1243-1251, August, 1979. 3 Fig, 5 Tab, 12 Ref. OWRT-A-058-NC(3), 14-31-0001-3533.

Descriptors: *Water pollution sources, *Dairy industry, *Industrial wastes, Water quality, Industrial effluents, Waste water characterization, Surcharges, Water costs, *Industrial water, Sewers.

Wastewater characteristics in a multi-product dairy plant were determined in two major drains and for several operations. Monitored characteristics included flow, biochemical oxygen demand, chemical oxygen demand, total suspended solids, total solids, fat, and temperature. Overall, 2.3 liters of wastewater/kg of product were discharged with average concentrations of 3049 mg/liter biochemical oxygen demand, 5451 mg/liter chemical oxygen demand, 2203 mg/liter total suspended solids, 9574 mg/liter total solids, and 1424 mg/liter fat. The biochemical oxygen demand coefficient was 6.91 g/kg of product. Day-to-day variations of waste load/unit product were large. Peak day measures were more than 10 times as high as minimum day measures. Waste load discharged from the plant was related to losses of milk and fat. Losses of milk and milk fat calculated from waste characteristics were greater than indicated by plant records. Municipal charges for water, sewer, and surcharges for a plant processing 200,000 kg of product per day with the average characteristics in this study were predicted to be approximately $18,600 per month. Waste loads for selected operations are presented with suggestions for reduction.
W81-01170

5G. Water Quality Control

A ONE-DIMENSIONAL, STEADY-STATE, DISSOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR LITTLE LAUGHERY CREEK, RIPLEY AND FRANKLIN COUNTIES, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-01025

VIRUSES IN GROUNDWATER,
Baylor Coll. of Medicine, Houston, TX.
For primary bibliographic entry see Field 5B.
W81-01121

AN AUTOMATED SYSTEM FOR MONITORING THE KINETICS OF BIOLOGICAL OXIDATION OF AMMONIA,
Consiglio Nazionale delle Ricerche, Rome (Italy). Inst. for Water Research.
For primary bibliographic entry see Field 5B.
W81-01135

EFFICIENT DESIGN OF STORMWATER HOLDING BASINS USED FOR WATER QUALITY PROTECTION,
North Dakota State Univ., Fargo. Dept. of Civil Engineering.
D. M. Griffin, Jr., C. Randall, and T. J. Grizzard.
Water Research, Vol 14, No 10, p 1549-1554, October, 1980. 6 Fig, 2 Tab, 6 Ref.

Descriptors: *Runoff, *Urban runoff, *Storm drains, On-site data collections, Rainfall-runoff relationships, Small watersheds, Design data, Design criteria, *Water pollution control, Suspended solids, Field data, Settling basins, Unit hydrographs, Water pollution sources, Surface runoff, Storm water.

A rational method for the design of stormwater basins is proposed, and a design example is presented. The method is based on the retention of a predetermined fraction of the pollution load leaving a catchment. Holding basin dimensions can be determined given a known runoff volume required to trap a desired mass of pollutants. The parameters are calculated from data which includes a design storm event, the relationship between total runoff volume and total pollutant load, and a loading curve. Though this data is not yet commonly available it may be possible to generalize loading curves for various types of land use with additional research. It is anticipated that the proposed design method could result in smaller holding basins than if designs were based on runoff volume. (Titus-FRC)
W81-01136

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

PLANNING AND DESIGN OF STUDIES FOR RIVER-QUALITY ASSESSMENT IN THE TRUCKEE AND CARSON RIVER BASINS, CALIFORNIA AND NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
J. O. Nowlin, W. M. Brown, III, L. H. Smith, and R. J. Hoffman.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $10.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-435, June, 1980. 75 p, 11 Fig, 14 Tab, 46 Ref.

Descriptors: Evaluation, *Water quality, *River basins, Planning, *Water resources development, Assessments, Water pollution sources, Aquatic environment, Management, Methodology, Mathematical models, Simulation analysis, Land use, California, Nevada, *Truckee River basin(CA-NV), *Carson River basin(CA-NV).

The objectives of the Geological Survey's river-quality assessment in the Truckee and Carson River basins in California and Nevada are to identify the significant resource management problems; to develop techniques to assess the problems; and to effectively communicate results to responsible managers. Six major elements of the assessment to be completed by October 1981 are (1) a detailing of the legal, institutional, and structural development of water resources in the basins and the current problems and conflicts; (2) a compilation and synthesis of the physical hydrology of the basins; (3) development of a special workshop approach to involve local management in the direction and results of the study; (4) development of a comprehensive streamflow model emcompassing both basins to provide a quantitative hydrologic framework for water-quality analysis; (5) development of a water-quality transport model for selected constituents and characteristics on selected reaches of the Truckee River; and (6) a detailed examination of selected fish habitats for specified reaches of the Truckee River. Progress will be periodically reported in reports, maps, computer data files, mathematical models, a bibliography, and public presentations. In building a basic framework to develop techniques, the basins were viewed as a single hydrologic unit because of interconnecting diversion structures. The framework comprises 13 hydrographic subunits to facilitate modeling and sampling. Several significant issues beyond the scope of the assessment were considered as supplementary proposals; water-quality loadings in Truckee and Carson Rivers, urban runoff in Reno and management alternatives, and a model of limnological processes in Lahontan Reservoir. (USGS)
W81-01024

MODEL EVALUATION OF THE HYDROGEOLOGY OF THE MORRIS BRIDGE WELL FIELD AND VICINITY IN WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
P. D. Ryder, D. M. Johnson, and J. M. Gerhart
Geological Survey Water-Resources Investigations 80-29, 1980. 92 p, 35 Fig, 2 Tab, 28 Ref.

Descriptors: *Model studies, *Hydrogeology, *Potentiometric level, *Simulation analysis, *Florida, Water wells, Aquifer characteristics, Groundwater movement, Water supply, Groundwater resources, Pumping, *Floridan aquifer, *Morris Bridge well field, West-central Florida.

The Morris Bridge well field in west-central Florida, which is being developed may have a maximum well-field withdrawal of 40 million gallons per day. The water will be pumped from the Floridan aquifer--a sequence of carbonate rocks about 1,100 feet thick underlying surficial sand and clay deposits. A highly fractured and transmissive zone about 500 feet below National Geodetic Vertical Datum of 1929 will supply a large proportion of the water. Two-dimensional and three-dimensional digital flow models were used to evaluate the hydrogeology of the area. The model-derived leakance distribution (a property of the confining bed) for a 285-square-mile area ranged from 0.00002 to 0.008 per day. Model-derived transmissivity values for the Floridan aquifer ranged from 37,000 to 600,000 feet squared per day. Model-derived specific yield values for the surficial aquifer ranged from 0.05 to 0.30. The three-dimensional model was used to predict drawdowns in both the Floridan and surficial aquifers in response to a 40 million gallon per day stress. Mass-balance data from a 30-day simulation with no recharge from rainfall show percentage of withdrawn water that is derived from: (1) aquifer storage, (2) the Hillsborough River, and (3) reduction of evapotranspiration losses. (USGS)
W81-01027

AN ECONOMIC ANALYSIS OF SELECTED STRATEGIES FOR DISSOLVED-OXYGEN MANAGEMENT: CHATTAHOOCHEE RIVER, GEORGIA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-01036

CONSERVATION V. LAND DRAINAGE - A GUIDE FOR THE FUTURE,
Water Space Amenity Commission, London (England).
S. Lucas.
Water, No 34, p 7-10, September, 1980.

Descriptors: *Controlled drainage, *Drainage programs, *Drainage effects, *Wildlife conservation, *Land management, Natural resources, Protection, Compensation, Comprehensive planning, Industries, Engineering, Water policy, Farm management, Governments, Watersheds, Adoption of practices, Grants, Planning, Projects.

The Water Space Amenity Commission's conservation and land drainage guidelines advise on how to minimize environmental damage related to land drainage schemes. They include three sections: advisory notes, practice notes addressing specific environments, and appendices. The guidelines stress regional consultation and are intended for use by industry. Initiated in 1974, they were drafted by experts representing both conservation and drainage interests. The need for drainage and cost benefit analyses is not discussed. In a supplementary report issues such as compensation and areas where scientific research is needed are discussed, and case studies of controversial sites in England and Wales are presented. (Titus-FRC)
W81-01048

DEVELOPMENT AND USE OF A MATHEMATICAL MODEL OF THE SAN BERNARDINO VALLEY GROUND-WATER BASIN, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-01186

WATER-QUALITY INVESTIGATION OF THE CANEY CREEK WATERSHED, NORTHEAST ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
T. E. Lamb, and G. Newsom.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $2.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 79-1064, 1979. 16 p, 1 Fig, 3 Tab, 11 Ref.

Descriptors: *Water quality, *Baseline studies, *Surface waters, *Groundwater resources, *Arkansas, Watershed management, Topography, Geology, Aquifers, Water analysis, Sampling, Chemical properties, Physical properties, Planning, Presoil conservation programs, *Caney Creek watershed(AR), *Northeast Arkansas.

The results of a 1-year study, in 1977-78, of surface-water quality in the Caney Creek watershed, northeast Arkansas, are presented to document conditions before implementation of Soil Conservation Service programs. The report includes a general description of the watershed's topography, geology, and aquifers, and the results of several measurements at two sites of discharge, and a number of physical and chemical parameters. (USGS)
W81-01189

TEST MONITORING OF PROTOTYPE INJECTION WELL, WAIALE, MAUI, HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
R. L. Soroos.
Geological Survey Open-File Report 79-274, January, 1979. 31 p, 7 Fig, 6 Tab, 5 Ref.

Descriptors: *Monitoring, *Injection wells, *Testing, *Hawaii, Pumping, Observation wells, Storm runoff, Groundwater, Water quality, Data collections, Hydrographs, *Maui(HI), Baseline studies, Urban runoff, Water quality control.

A high-capacity prototype injection well was tested in the isthmus area of Maui, Hawaii. Pumping tests were made on April 14 and 15, 1978, and 10 injection tests were made between May 12 and June 30, 1978. Selected tests were monitored in order to obtain data which could be used to assess the effects of subsurface disposal on the ground water in the basal aquifer. Pumping and injection rates were measured. Basal-water head responses to pumping and injection were observed at the prototype well and at two observation wells located 435 and 6,100 feet from the prototype well. Water-quality samples were collected at the prototype well and the nearest observation well prior to testing. Samples of the injection water, as well as samples from the observation wells, were collected prior to and after the final test. The head data and water-quality data are presented in this report. (USGS)
W81-01190

QUALITY OF WATER IN THE BLACK RIVER NEAR DUNN, NORTH CAROLINA, AND GROUND-WATER LEVELS ADJACENT TO THE RIVER PRIOR TO CHANNEL EXCAVATION IN 1976-79,
Geological Survey, Raleigh, NC. Water Resources Div.
C. E. Simmons.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $2.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-425, 1980. 18 p, 4 Fig, 4 Tab, 1 Ref.

Descriptors: *Water quality, *Channel improvement, *Streams, *Water levels, *North Carolina, Small watersheds, Flow rates, Storm runoff, Streamflow, Sediment yield, Water temperature, Water analysis, Bacteria, Surface-groundwater relationships, Hydrologic data, *Black River(NC), Baseline studies, Effects, Dredging, *Flood control.

During 1976-79 data were collected at three sites on the Black River, near Dunn, North Carolina, to define water-quality and other hydrologic conditions prior to channel excavation. Samples collected over a range in flow from 1.2 to 900 cubic feet per second contained 1 to 81 mg/L (milligrams per liter) of suspended sediment, 37 to 108 mg/L of dissolved solids, and 0.21 to 1.0 mg/L of total nitrogen. Water-level fluctuations in wells located within 100 feet of the Black River were almost identical with those of the stream. (USGS)
W81-01193

6B. Evaluation Process

WATER RESOURCES RESEARCH COORDINATION AND PLANNING IN THE MISSOURI RIVER BASIN.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-147803, Price codes: A03 in paper copy, A01 in microfiche. Missouri River Basin Region Water Resources Research Institutes Project Completion Report, March, 1978. 35 p. OWRT-B-038-NEB(1), 14-34-0001-7203.

Descriptors: *Water resources planning, *Regional analysis, Water problems, *Groundwater resources, *Groundwater allocation(Policy), *Missouri River basin, Project planning, Financial feasibility.

The main objectives in this project were to: (1) identify and categorize water problems; (2) develop alternatives and regional research proposals for finding their solutions; (3) develop financial plans for research within the region; and (4) provide a means of communication between the institutes for the exchange of ideas on water resources research in the basin. The Missouri River Basin Water Institute Consortium (MRBWIC) selected a particular problem to receive most of its attention. This was the problem of the allocation of the diminishing groundwater supplies in the Basin. MRBWIC worked closely with the Missouri River Basin Commission in conducting a workshop of groundwater allocation and publishing the proceedings. Research needs to make sound decisions on water allocations were developed and the cost of this research estimated.
W81-01003

WASTEWATER TREATMENT PROCESS EVALUATED BY FORCE ACCOUNT,
Montana State Univ., Bozeman.
R. L. Sanks, J. W. Tacke, and J. E. Connell.
Public Works, Vol 111, No 11, p 82-84, November, 1980. 1 Fig.

Descriptors: *Waste water treatment, *Sewage treatment, *Municipal wastes, *Cost-benefit analysis, Pilot plants, Force account, Rotating biological contactor, Filtration, Livingston(MT), Yellowstone River, Montana.

The city of Livingston, Montana, population 8,000, used the force account approach to evaluate a rotating biological contactor which had been proposed as part of a $3.5 million treatment plant expansion. A full-sized rotating contactor was too costly to test. Therefore, 48 four foot diameter discs were tested. Construction of the pilot plant was largely done by city employees. Most of the operation was done by a university student. Although analyses were originally planned to be done by city employees, most procedures were eventually contracted to the university. The pilot plant program, which cost less than $24,000, showed that the surface area of the units should be increased by 10%. Plant operators and city personnel, having been involved with the testing program, readily accepted the new system and accumulated considerable experience for operation of the full-scale plant. (Cassar-FRC)
W81-01086

AN ECONOMIC EVALUATION OF THE FEASIBILITY OF ARTIFICIAL GROUNDWATER RECHARGE IN NEBRASKA,
Nebraska Univ.-Lincoln. Dept. of Agricultural Economics.
R. J. Supalla.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-148066, Price codes: A03 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska, Project Completion Report, January, 1981. 30 p. OWRT-A-065-NEB(1), 14-34-0001-9029.

Descriptors: *Artificial recharge, *Groundwater recharge, Economics, Groundwater management, *Irrigation water, *Economic feasibility, *Nebraska, Cost-benefit analysis, Evaluation.

The purpose of this project was to analyze the economic feasibility of recharge for irrigation use. This involved developing a procedure for estimating recharge benefits, application of the benefit estimating procedure to a proposed Nebraska case, and a review of the literature regarding recharge program costs. The benefit estimating procedure considers two types of benefits: those due to reduced pumping lifts and those due to extended aquifer life. Procedures regarding a minimum amount of data were specified for each of these components. It was found that recharge benefits in irrigation use areas could range from less than $2 to nearly $20 an acre-foot, with the most likely value being in the $15 to $10 range. This range of values reflects different assumptions regarding lift effects, energy prices, farm commodity prices and discount rates. When estimated benefits were compared to available published data on recharge costs, it was found that single-purpose recharge projects to augment water supplies for irrigation would be economically infeasible in most cases. If artificial recharge is to be a viable option, it must be pursued as part of a multi-purpose water development project.
W81-01155

DESIGN OF OBJECTIVE FUNCTIONS FOR RESERVOIR OPERATIONS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. T. Westgate.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150229, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis, Fall, 1980. 74 p, 42 Ref. OWRT-B-195-COLO(3).

Descriptors: *Reservoirs, Objective functions, *Reservoir operation, Objective change, *Multiple-purpose reservoirs, Reviews, Evaluation, *Optimum development plans.

This research investigates the objective function as a potential weak link in the application of the tools of water resources research to the problems of reservoir operations. Reservoir systems are continually evolving due to changes in the systems' purposes, capabilities, or hydrology. In response to these changes, Reservoir Operations is called upon to evaluate alternative operations policies for their

performance on system objectives. Reservoirs often have multiple purposes, and these purposes have multiple performance measures. A catalog of performance measures found in the water resources literature is presented along with a methodology for selecting the performance measures to be used for the objective function of the analysis.
W81-01169

AGRICULTURE AND HYDRO-POWER: COSTS, BENEFITS, AND TRADE-OFFS,
Oregon State Univ., Corvallis. Dept. of Agricultural and Resource Economics.
F. W. Obermiller.
In: Conflicts Over the Columbia River, Seminar conducted by Water Resources Research Institute, Oregon State University, Corvallis, Spring Quarter 1980. Report SEMIN WR 028-80. July, 1980, p 57-64. 2 Fig, 8 Ref.

Descriptors: *Columbia River, *Hydroelectric power, *Cost-benefit analysis, *Irrigation programs, *Cost comparisons, Unit costs, Income analysis, Cost sharing, Input-output analysis, Energy loss, Income, Return flow, Diversion losses, Agriculture.

It has been predicted that within four to five years, the Columbia River's system-wide water supplies will be fully utilized. Tradeoffs must be considered. One involves the benefits resulting from increases in irrigated agriculture versus the opportunities foregone because of outstream diversion of system waters. There are primary (direct), secondary (indirect), and public benefits and costs as a result of irrigation development. Using price, cost, crop, and acreage projections, the net primary benefits of future irrigation development can be derived. Future primary benefits 'with irrigation' might be $43 million per year, or $220/acre-year. Correcting for higher energy pumping and other costs, the net benefits could be $32/acre-year. The net secondary benefits would increase local non-agricultural household income to the equivalent of $237/acre-year. The net social benefits, the sum of the primary and secondary benefits, should exceed $270/acre-year. However, the value of lost hydroelectric generating capacity must be considered. The calculations given derive an 'opportunity cost' figure of $37.80/acre to replace foregone electric power. Viewed purely from an efficiency standpoint, the Columbia River water has a higher value in irrigation than in hydroelectric power generation. From an equity perspective the verdict is less clear, since the cost of replacing the lost electric power would be borne mostly by people who would not benefit directly from the irrigation. However, if local beneficiaries were to compensate non-local users of electricity, the tradeoff would be both efficient and fair. (Atkins-Omniplan)
W81-01199

NAVIGATION AS AN ALTERNATIVE USE,
Oregon State Univ., Corvallis. Dept. of Agricultural and Resource Economics.
M. V. Martin.
In: Conflicts Over the Columbia River, Seminar conducted by Water Resources Research Institute, Oregon State University, Corvallis, Spring Quarter 1980. Report SEMIN WR 028-80. July, 1980, p 89-107. 1 Fig, 7 Tab.

Descriptors: *Columbia River, *Cost-benefit analysis, *Transportation, *Navigation, Water resources development, Income distribution, Social impact, Economics, Commercial fishing, Barges, Data collections.

Navigational use of the Columbia River's water resources makes a variety of contributions to the economy of the Pacific Northwest. Recent navigation improvements have increased transportation activity on the river. The benefits from commerical navigation arise from on-river downstream movements, off-river movements, upriver movements, capacity availability and developmental influences. On-river barge transportation directly benefits shippers (producers) and ultimately consumers. Low barge rates reduce the delivered price of commodities shipped to upriver areas. Likewise, intermodal competition depresses rail rates. A high-capacity barge system lessens the possibility of a peak period shortage of transportation. Output, employment and income multipliers illustrate how navigation stimulates the economy. There are direct and indirect costs of commercial navigation. Direct costs include construction, maintenance and operation of navigational aids. Indirect costs include foregone energy generation, water loss for irrigation, road damage and damage to the river ecology. Often the direct beneficiaries do not bear the incidence of the associated costs. However, it can be argued that society is served from such subsidies. Tradeoffs to allocate the river's resources have to be made and commercial navigation must be considered along with other uses. (Atkins-Omniplan)
W81-01202

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

WHOLESALE WATER PRICING: A COST-TO-SERVE PLAN THAT WORKS,
K. Grover.
American City and County, Vol 95, No 11, p 65-67, November, 1980.

Descriptors: *Cost allocation, *Water rates, Economics, *Pricing, Cost sharing, Water policy, Cost analysis.

A new financing system put into effect by the Portland, Oregon, Water Bureau has allowed the Bureau to create the revenues it needed to accomplish capital improvement programs and ensure future water stability to the area it serves. The system uses a utility enterprise basis for determining a utility's revenue requirements, a capacity-commodity rate based on cost-to-serve figures, a separate customer service charge, a guaranteed sale of water to all purveyors, a system wherein financing responsibility for new facilities designed to benefit a purveyor or purveyors is assumed by the purveyor(s), and a growth impact charge. Regular monthly meetings are held to avoid any lack of communication problems between the Water Managers' Advisory Board and the Bureau. In place of 10 yr purveyor contracts, Portland has secured 25 yr contracts with all except one of its 42 purveyors. (Baker-FRC)
W81-01104

INTERNATIONAL MANAGEMENT OF THE COLUMBIA,
Oregon State Univ., Corvallis. Dept. of Geography.
For primary bibliographic entry see Field 6E.
W81-01201

6D. Water Demand

WATER USAGE PATTERNS IN THE U.S. VIRGIN ISLANDS,
Caribbean Research Inst., St. Thomas (Virgin Islands). Water Resources Research Center.
D. C. Bullock, R. W. Peebles, and H. H. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-147829. Price codes: A03 in paper copy, A01 in microfiche. Completion Report, August, 1980. 26 p, 24 Tab, 10 Ref, 1 Append. OWRT-A-011-VI(1), 14-34-0001-9050.

Descriptors: *Water utilization, *Virgin Islands, *Water distribution(Applied), *Consumptive use, *Water management(Applied), Use rates, Geographical regions, Islands, Regions, Precipitation(Atmospheric), Water sources, Use of water, Potable water, Recreation, Water conservation, Water demand, Water rates, Water resources, Planning, Estimating.

This study was conducted to develop an original data set on the water use pattern for dwelling units occupied by residents and tourists, and to analyze the data to provide per capita demand figures for residential water use in light of increasing water supply costs. Thirteen dwelling units were selected and monitored by the installation of a novel clock-pressure switch water measurement system for a monitoring project that covered 1790 dwelling unit days involving 5900 people days, from November 1979 to July 1980. Major user categories included tourists, residents of island origin, and resident continentals. All but one site were owner operated and none of the units depended on piped/desalted water. Over 90% of the water used was supplied by rainfall. The major conclusion of the study was that high standards of living can be maintained in the U.S. Virgin Islands with an average domestic water usage of less than 40 and perhaps as low as 30 gallons per person per day. Residential water usage can be cut at least in half if the occupants have sufficient economic incentives to conserve water. Residents of island origin are more conservative than residents of continental origin if sufficient financial incentives exist. (Zielinski-IPA)
W81-01005

PLANNING AND DESIGN OF STUDIES FOR RIVER-QUALITY ASSESSMENT IN THE TRUCKEE AND CARSON RIVER BASINS, CALIFORNIA AND NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 6A.
W81-01024

THE COLUMBIA RIVER: PROTEIN, POWER, PRESERVATION, AND POLITICS,
Haggard, Tousley and Brain, Seattle, WA.
J. E. Haggard.
In: Conflicts Over the Columbia River, Seminar conducted by Water Resources Research Institute, Oregon State University, Corvallis, Spring Quarter 1980. Report SEMIN WR 028-80. July, 1980, p 33-44.

Descriptors: *Columbia River, *Irrigation, *Hydroelectric power, *Hydroelectric power plants, *Anadromous fish, *Consumptive use, Wildlife, Water allocation(Policy), Beneficial use, Federal-state water rights conflicts, Jurisdiction, Local governments, State governments, Planning, Dams

The Columbia River is not just a power resource. It is also used for transportation, flood control, irrigation, recreation, water supply, flow augmentation, fishing, tourism, and habitat for anadromous fish, wildlife and water fowl. With increasing usage, it is evident that existing water supply is not adequate to meet all expected consumptive and instream river uses. Any future commitment of the Columbia's water will involve a cost or tradeoff to some other water use. What is done in one locality affects many others. The use of the river, therefore, requires a system of allocation which recognizes the diversity of interest and demand. A method of dispute resolution is needed that addresses reasonable claims without sacrificing the interests of uninvolved or inactive users. A reasonable accommodation must be made between instream and out-of-stream users, and among users in each category. Future needs should be recognized while realizing that our present perceptions of these needs will vary. A compact between the states and the federal government is desirable; however, political realities may prevent the fruition of an interstate compact for the river in this century. (Atkins-Omniplan)
W81-01198

6E. Water Law and Institutions

FISCAL 1980 ANNUAL REPORT TO OFFICE OF WATER RESEARCH AND TECHNOLOGY, USDI.
Pennsylvania State Univ., University, PA. Inst. for Research on Land and Water Resources
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-147811. Price codes: A05 in paper copy, A01 in microfiche. December 1980. 92 p.

Descriptors: *Pennsylvania, Acid mine water, *Information retrieval, *Water supply, *Projects, Water pollution control, Pollutant identification,

Floods, Water quality control, Resources development, Water conservation, Waste treatment, Potable water, Runoff, Erosion, Infiltration, Heavy metals, Streams, Mine drainage, Ecology, *Watershed management, Evaluation, Renovation of wastewater, Technology transfer, Spray irrigation, Nonpoint source pollution, Mound systems, Stream eutrophication, Acid snow.

This publication is the Fiscal 1980 Annual Report of the Water Resources Center, Institute for Research on Land and Water Resources, The Pennsylvania State University. In its reporting of the OWRT funded allotment and matching grant research projects, the report satisfies the reporting requirements of the Office of Water Research and Technology under P.L. 88-379. In addition to the Director's summary statement and a narrative report for each project, the training and education aspects of the Water Research Program under P.L. 88-379 are reported. Numerous broad lines of research are reported with concentrations in the following areas: water supply, water quality management and control, planning for future resource development, water conservation, water utility financing, low flow requirements for in-stream use, nonpoint source pollution, innovative waste treatment, on-site effluent disposal mound system evaluation, study of acid snow, effects of spray irrigation on wildlife, and acid mine drainage. (Tsong-PA)
W81-01004

CONCERN OVER THE COLUMBIA ESTUARY,
Pacific Northwest River Basins Commission, Vancouver, WA.
R. Moulton.
In: Conflicts Over the Columbia River, Seminar conducted by Water Resources Research Institute Oregon State University, Corvallis, Spring Quarter 1980. Report SEMIN WR 028-80, July, 1980, p 13-27. 1 Fig, 8 Ref.

Descriptors: *Columbia River, *Washington, *River Basin Commissions, *Estuaries, Watershed protection, Allocation(Cost), Pacific Coast region, Resource allocation, Water resources development, Regional development.

The need to allocate the use of the Columbia River's resources has forced government to plan, make judgements and enforce these judgements through a variety of mechanisms. Except for an investigation by the Atomic Energy Commission in the early 1960's, no comprehensive study of the estuary's resources has been made until recently. To coordinate the efforts of Washington and Oregon, the Columbia River Estuary Study Taskforce (CREST) was formed in 1975. In 1967, the Pacific Northwest River Basins Commission (PNRBC) was established to coordinate water resources activities in the five Pacific Northwest States. One of its purposes was to undertake special studies of water and related land resources. For this reason, the Columbia River Estuary Data Development Program (CREDDP) was initiated. The CREDDP's purpose is twofold: to increase understanding of the Columbia River Estuary as a system, and to acquire information needed for making specific land/water management systems. Funding is provided by Public Works Bill P.L. 95-482. The program will be in seven phases over a six-year period. Policy guidance will be through the PNRBC. Technical guidance will come from a Technical Advisory Committee working through a Program Manager who is on the Committee staff. The work of the program is being performed by a mix of 18 federal/state agencies, academic institutions, and private contractors or individuals working on 28 contracts. Roles, functions and services to be provided by these groups or individuals are described. A summary of the 28 contracts, including dollar amounts, is listed. (Atkins-Omniplan)
W81-01011

EFFECTIVE WASTEWATER MANAGEMENT PLANNING FOR SMALL COMMUNITIES - PART 2,
California Univ., Davis. Dept. of Civil Engineering.
R. F. Barror, and G. Tchobanoglous.
Public Works, Vol 111, No 9, p 125-127, 170, 172, 174, September, 1980. 1 Tab, 8 Ref.

Descriptors: *Management, *Water management(Applied), *Planning, *Waste water treatment, Administration, Comprehensive planning, Design, Systems analysis.

Key innovative wastewater management planning concepts effective for small communities are discussed. The fact that small communities must examine the problems of waste water treatment from a different viewpoint is stressed. Simply scaling down large size operations is not necessarily the best approach. Even though these originally large-scale operations can still function on a small scale, they are often far more costly than a totally new design for a system on a small scale would have been. Innovative planning is needed for the small community. Land and labor utilization must be considered. Three types of water treatment processes which use land either directly or indirectly are ponds (oxidation ponds), land treatment systems (crop irrigation, overland flow and rapid infiltration) and aquatic systems (wetlands and aquaculture applications). Important aspects of land based systems for the small community are described. The effective utilization of labor is considered, including plans to hire unskilled labor through the use of welfare and unemployment funds. (Baker-FRC)
W81-01083

MANAGEMENT AUDITS FOR THE 80'S,
Andersen (Arthur) and Co., Hartford, CT.
E. F. Bader.
Journal of the New England Water Works Association, Vol 94, No 3, p 240-254, September, 1980. 1 Tab.

Descriptors: *Management, *Planning, *Regulation, *Audits, Productivity, Projections, Administrative agencies, Public utilities.

Management audits in utilities by financial and regulatory agencies will increase in the next decade for the following reasons: strong demand for improved economy and efficiency, a high level of consumer activism, emphasis on improved productivity, and pressure on regulatory commissions. The 1980's may see these increasing trends: involvement of commissions in management's decision-making procedures, municipalization, emphasis on documentation to demonstrate efficiency, specialization in scope of audits, and communication with regulatory commissions and the public. Managers may become better prepared for audits by conducting internal reviews, identifying areas for improvement with specific plans for these improvements, reducing exposure in high visibility areas, documenting accomplishments, and communicating actions and plans to the commissions. Specific steps for organizing a pre-audit review are described. (Cassar-FRC)
W81-01098

WATER PROBLEMS AND RESEARCH NEEDS FOR WISCONSIN, A 5-YEAR PLAN,
Wisconsin Univ.-Madison. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150203, Price codes: A06 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, September, 1980. 98 p, 9 Fig, 10 Tab, 22 Ref.

Descriptors: *Research priorities, *Wisconsin, *Planning, *Research and development, *Water quality, Water management(Applied), Water resources, Water pollution, Institutions, Optimum development plans, Evaluation, Programs, Investigations, Project planning, Alternative planning, Water utilization, Toxins, Wetlands, Information exchange, Governments, *Five-year plans.

This report provides an overview of available information on Wisconsin's water resources, shorelands, and water use, and includes a summary of State management and planning activities. This information provided the basis for categorization of problem areas and identification of research needs in development of a five-year plan. Wisconsin's water resources were summarized under: general geology; precipitation and water budget; groundwater (covering quantity, quality and quality management); surface water (rivers/streams, surface water quantity/quality monitoring, inland and Great Lakes); wetlands; shorelands; and water use (river basins, waste water discharges, agriculture, navigation, recreation, fish/wildlife). The identified water research priorities for Wisconsin's five-year plan were developed into eight categories: hazardous materials in the environment; acid precipitation and trace contaminants; nonpoint source pollution; wetlands, recreation; technology transfer, information dissemination, and education program; human health effects; and intergovernmental and intragovernmental activities. The eight identified priority categories were discussed in detail. (Zielinski-IPA)
W81-01159

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN, FISCAL YEARS 1982-1986.
Rutgers-The State Univ., New Brunswick, NJ. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150195, Price codes: A03 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, December, 1980. 42 p, 6 Fig, 9 Tab, 8 Ref.

Descriptors: *Research priorities, *New Jersey, *Planning, *Research and development, *Water quality, Water management(Applied), Water resources, Water pollution, Institutions, Optimum development plans, Evaluation, Programs, Investigations, Project planning, Alternative planning, Water utilization, Toxins, Chemicals, Storm water, Groundwater, *Five-year plans.

This report has described the current condition of New Jersey's water resources, has identified priority State issues likely to be of major concern during the next five years, and has proposed a research agenda to address priority problems. Twelve State-wide high-priority issues were defined: sewage treatment plant discharges; industrial discharges; landfill dumping; on-site disposal (septic); accidental spills/leaks; urban storm runoff; agricultural runoff/seepage; suburban/rural runoff; purveyor deficits; surface supplies reaching maximum development capacity; fragmentation of water supply network; and groundwater supplies reaching maximum development. Integration of issues identified five broad priority categories: water quality management planning; toxics and hazardous control; groundwater management; nonpoint source control; and point source control. The Institute's three key research priorities, identified by assistance from response to the Institute's questionnaire, represent the proposed research agenda for the next five years: (1) impact of hazardous and/or toxic chemicals on the quality of ground/surface waters; (2) stormwater and nonpoint source management issues; and (3) water quantity issues. Justification and research objectives for these three priorities were discussed. (Zielinski-IPA)
W81-01160

THE ORR DITCH CASE, 1913-1944,
Nevada Historical Society, Reno.
J. M. Townley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150286, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center, University of Nevada, Reno, Desert Research Institute Publication 43007, October, 1980. 90 p, 2 Tab. OWRT-A-080-NEV(1), A-087-NEV(1), 14-34-0001-8030, 14-34-0001-9030.

Descriptors: *History, *Water rights, *Rivers, *Water utilization, *Judicial decision, Riparian rights, River basin development, Biographies, Legal aspects, Water law, Jurisdiction, Bodies of water, Nevada, Institutional constraints, Administration, Water policy, Legislation, Reservation

doctrine, Project planning, Water management(Applied).

The first cooperative report of the Nevada Historical Society and the Desert Research Institute's Water Resources Center describes the results of a project, the objective of which was to make the Orr Ditch case and succeeding litigation understandable in a humanistic sense. Hence, considerable use was made of the term 'equity', and the report has focused on a comparison of the suit's results with the concept of an equitable division of water resources among Truckee River users, rather than legal formalities. This report has also examined the motives and actions of the major parties involved. The case, which arose from the government's need to rectify its management of the Truckee-Carson project, took over three decades (1912-1944) of courtroom argument and detailed field analysis to complete. The final decree (1944) perpetuated earlier findings and contained no significant variance to the Truckee River Agreement of 1935. From experience of the Orr Ditch suit, this report concluded that, once finite water rights are identified, they must be enforced by an agency that is free of influence of water users, and that will distribute resources statutorily; otherwise a regulatory decree quickly becomes nonfunctional. (Zielinski-IPA)
W81-01161

PLANNING FOR FISCAL YEARS 1982/1986.
Delaware Univ., Newark. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150260, Price codes: A05 paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, November, 1980. 83 p, 6 Fig, 9 Tab, 15 Ref, 2 Append.

Descriptors: *Research priorities, *Delaware, *Planning, *Research and development, *Water quality, Water management(Applied), Water resources, Water pollution, Institutions, Optimum development plans, Evaluation, Programs, Investigations, Project planning, Alternative planning, Water utilization, Toxins, Groundwater, Delaware River, Bays, *Five-year plans.

This five-year report covered State geological information (aquifers, surface water, climate, land use), water quality and use, governmental and other agencies and their anticipated fiscal year 1981 activities, Delaware's water problem categories, and has identified research priorities. The five-year plan was presented in two forms: (1) the foreseeable immediate future and factors that will guide the State water resources Center's decisions; and (2) a fiscal breakout for the five-year plan. Identified Delaware water problems were discussed under water resources planning/management, water supply (including distribution systems and quality), groundwater contamination, and waste treatment/disposal categories. Thirteen research priorities were classified as either critical, urgent, or important. Critical area priority categories were: atmospheric, hydrologic, and hydraulic processes (groundwater contamination from landfill/waste disposal sites; predictive subsurface contaminant migration study); water resources management (economics study for water conservation program for public/industrial/agricultural sectors); and institutional, political, legal, behavioral, and economic analysis (evaluation of up-river management effects on Delaware River and Bay in Delaware). (Zielinski-IPA)
W81-01163

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN, FISCAL YEARS 1982-1986,
Ohio State Univ., Columbus. Water Resources Center.
R. L. Vertrees, and R. C. Stiefel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150211, Price codes: A04 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October, 1980. 59 p, 3 Fig, 5 Tab, 71 Ref.

Descriptors: *Research priorities, *Ohio, *Planning, *Research and development, *Water quality, Water management(Applied), Water resources, Water pollution, Institutions, Optimum development plans, Evaluation, Programs, Investigation, Project planning, Alternative planning, Water utilization, Toxins, Flooding, Drainage, *Five-year plans.

Adequate water is available from precipitation, the Ohio River and Lake Erie to meet Ohio's immediate needs. Most of Ohio's water-related problems are associated with water quality. Large quantities of waste products are produced from point/diffuse sources, developing concerns in surface runoff from urban, agricultural and mining areas over the State. The potential contamination of groundwaters by toxic/hazardous wastes represents a critical water resources problem. Other major water-related problems include: impact assessment of water development projects on wetlands/recreational activities; quantification of instream flow needs to maintain aquatic organism species diversity; and impact assessment of acid precipitation on State stream/lake water quality. Ten identified problem areas were prioritized in developing the State's five-year water resources research and development plan: (1) pollution from diffuse sources (agricultural/urban runoff, mine drainage, on-site disposal); (2) drinking water contamination (surface/ground water); (3) toxic/hazardous waste disposal (land disposal, ground/surface water); (4) point source pollution; (5) impacts of flooding/drainage; (6) impacts of water resources development; (7) instream flow needs; (8) impacts of synthetic fuel development; (9) air pollution impacts; and (10) water supply allocation. (Zielinski-IPA)
W81-01164

THE COLUMBIA RIVER: PROTEIN, POWER, PRESERVATION, AND POLITICS,
Haggard, Tousley and Brain, Seattle, WA.
For primary bibliographic entry see Field 6D.
W81-01198

INTERNATIONAL MANAGEMENT OF THE COLUMBIA,
Oregon State Univ., Corvallis. Dept. of Geography.
K. W. Muckleston.
In: Conflicts over the Columbia River, Seminar conducted by Water Resources Research Institute, Oregon State University, Corvallis, Spring Quarter 1980, Report SEMIN WR 028-80. July, 1980, p 69-88. 4 Fig, 2 Tab, 26 Ref.

Descriptors: *Columbia River, *Canada, *International waters, *Treaties, Hydrographs, Hydroelectric power, Reservoirs, Storage capacity, Irrigation, Streamflow, Flood control, Dams, Drainage basins, Pumped storage, Water policy.

An agreement between the United States and Canada for the cooperative management of the Columbia River was developed over two decades, involving the provision and operation of storage reservoirs in Canada. By the early 1950's, it was evident that utilities in the Pacific Northwest would have difficulty meeting the growing peak demands for electrical energy during the fall and winter seasons. Shortfalls in the planned additional increments of upstream storage were at the root of the problem. In 1959, after fifteen years of study, the International Joint Commission presented alternative plans for development, noting that storage sites in Canada could be operated to the benefit of both countries. The Commission also calculated an apportionment of the costs/benefits to each country. Before implementation, the U.S. had to agree to benefit sharing: an equal division between the upstream and downstream countries of benefits that accrue in the downstream country as a result of storage in the upstream country. Quantifying the downstream benefits was complex, however, an agreement was reached in 1960 and the Columbia River Treaty was signed in 1961. The Protocol finalizing the Treaty was signed in 1964 after Canadian factions reached agreement on their distribution of the benefits. The Treaty's main water-related concerns were hydroelectric generation and flood mitigation. Which country benefited most is debatable but both received large blocks of electrical energy at a lesser cost than if developed independently. Future negotiations will consider flow augmentation, water quality enhancement, irrigation and recreation. (Atkins-Omniplan)
W81-01201

6G. Ecologic Impact Of Water Development

CONSERVATION V. LAND DRAINAGE - A GUIDE FOR THE FUTURE,
Water Space Amenity Commission, London (England).
For primary bibliographic entry see Field 6A.
W81-01048

OFFSHORE WATER INTAKES DESIGNED TO PROTECT FISH,
Stone and Webster Engineering Corp., Boston, MA. Hydrology Div.
Y. G. Mussalli, E. P. Taft, and J. Larsen.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No Hy 11, p 1885-1901, November, 1980. 9 Fig, 21 Ref.

Descriptors: *Hydraulic structures, *Fish barriers, *Water cooling, Fish harvest, Fish passages, Intakes, Fish behavior, Fish repellents, Infiltration, Environmental effects, Screens, Saline water fish, Sea water.

Cooling water intake structures situated at offshore locations frequently face problems of impingement and entrainment of fish. Not only does the entrapment of fish deter efficient water intake, but the loss of fish may affect future fish harvests and endanger populations of certain marine habitats. Five concepts to prevent the entrance of fish into cooling water intake equipment are reviewed to familiarize designers with the advantages and problems associated with each. The systems discussed include velocity caps, wide-spaced louvers, behavioral barriers, wedge-wire screens and infiltration intakes. Radial wells and wedge-wire screens are the most effective in preventing fish impingement; however, more work is needed for use of wedge-wire screens in once-through cooling systems. Behavioral barriers offer only limited prevention of fish entrainment. More research is also needed on the wide-spaced louver concept to make it a viable method of bypassing fish within offshore, velocity cap intakes. (Geiger-FRC)
W81-01070

7. RESOURCES DATA

7A. Network Design

PROGRAMS REVAP AND WEVAP FOR ESTIMATING AREAL EVAPOTRANSPIRATION AND LAKE EVAPORATION FROM CLIMATOLOGICAL OBSERVATIONS,
National Hydrology Research Inst., Ottawa (Ontario).
For primary bibliographic entry see Field 2D.
W81-01017

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN COLORADO--FISCAL YEAR 1980.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225. Price: $16.75 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 80-442, March, 1980. 111 p, 39 Fig, 1 Plate, 1 Tab. (Compiled by Blakely, S. R.)

Descriptors: *Water resources, *Colorado, *Surface waters, *Groundwater, *Water quality, Basic data collection, Projects, Maps, Colorado River basin, Missouri River basin(CO), Arkansas River basin(CO), Rio Grande basin(CO).

Water-resources data-collection activities for October 1, 1979, through September 30, 1980, are summarized for Colorado and bordering States. Fifty-four interpretive hydrologic investigations include: 9 statewide investigations, 6 regional investigations, 11 investigations in the Missouri River basin, 7 investigations in the Arkansas River basin, 3 investigations in the Rio Grande basin, 16 investigations in the Colorado River basin, and 2 multistate investigations. The summaries of the investigations consist of a map showing the location of the areas of investigations and a brief description of the investigation's purpose, objective, approach, progress, and plans. (USGS)
W81-01182

U.S. GEOLOGICAL SURVEY ACTIVITIES IN NEW YORK, 1979.
Geological Survey. Albany, NY. Water Resources Div.
Geological Survey Open-File Report 80-51, 1980. 124 p, 9 Fig, 2 Tab, (Finch, A., and Gori, P., compilers).

Descriptors: *New York, *Natural resources, *Projects, *Programs, Water resources, Land use, Mineralogy, Fuels, Water quality, Geologic investigations, Mapping, Energy, Bibliographies, *U.S. Geological Survey.

This report describes the work of the U.S. Geological Survey and summarizes projects conducted in New York during 1979. Many of these projects are continuing into the 1980's. The major programs provide basic scientific information concerning water, land, and mineral resources. The Survey also supervises the exploration for mineral fuels on leased outer continental shelf lands. The programs are: (1) Water resources investigations--These encompass (a) statewide networks of measurement stations that provide continuous records of streamflow, groundwater levels, water quality, and sediment discharge, and (b) projects to study local or regional water problems as well as critical water problems of national scope or interest. (2) Geologic and mineral resource surveys and mapping--These studies focus on geologic, mineral, and energy-resources investigations both on land and offshore. (3) Conservation of lands and mineral resources--These studies include the classification and evaluation of mineral resources on the outer continental shelf. (4) Topographic surveys and mapping--These studies include quadrangle, small-scale, and special mapping. (5) Land information and analysis--These studies focus on the interpretation and application of earth-science and related information to multi-disciplinary land-resource and environmental-impact problems. (USGS)
W81-01183

HYDROLOGIC INVESTIGATIONS IN THE ARAGUAIA-TOCANTINS RIVER BASIN (BRAZIL),
Geological Survey, Ocala, FL. Water Resources Div.
L. J. Snell.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $4.25 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 79-1599, 1979. 28 p, 5 Fig.

Descriptors: *Water resources development, *Networks, *River basins, Hydrologic data, Meteorological data, Gaging stations, Stream gages, Rain gages, *Brazil, *Rio Araguaia, *Rio Tocantins, *Project planning.

The Araguaia-Tocantins River basin system of central and northern Brazil drains an area of about 770,000 square kilometers and has the potential for supporting large-scale developments. During a short visit to the headquarters of the Interstate Commission for the Araguaia-Tocantins Valley and to several stream-gaging stations in June 1964, the author reviewed the status of the streamflow and meteorological data-collection programs in relation to the streamflow and meteorological data-collection programs in relation to the pressing needs of development project studies. To provide data for areal and project-site studies and for mainstream sites, an initial network of 33 stream gaging stations was proposed, including the 7 stations then in operation. Suggestions were made in regard to operations, staffing and equipment. Organizational responsibilities for operations were found to be divided uncertainly. The Brazilian Meteorological Service had 15 synoptic stations in operation in and near the basin, some in need of reconditioning. Plans were at hand for the addition of 15 sites to the synoptic network and for limited data collection at 27 other sites. The author proposed collection of precipitation data at about 50 other locations to achieve a more representative areal distribution. Temperature, evaporation, and upper-air data sites were suggested to enhance the prospective hydrometeorological studies. (USGS)
W81-01188

7B. Data Acquisition

REMOTELY SENSED CROP TEMPERATURE FOR WATER RESOURCES MANAGEMENT,
Nebraska Univ.-Lincoln. Center for Agricultural Meteorology and Climatology.
B. L. Blad.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-147795, Price codes: A12 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska, Project Completion Report, November, 1980. 247 p, 87 Fig, 18 Tab, 121 Ref, 4 Append. OWRT-B-044-NEB(2), 14-34-0001-8097.

Descriptors: *Crop temperature, Water stress, Irrigation scheduling, *Remote sensing, Evapotranspiration, *Crop response, *Temperature, Crop production, Forecasting, Irrigation practices, Water management(Applied).

The overall goal of the project was to evaluate the use of crop temperature data as a tool in the management of water resources. The specific objectives of the study were: (1) to determine the crop temperature response of some major agronomic crops to various levels of water stress; (2) to test methods based on crop temperature or other remotely sensed data to estimate crop water stress conditions and to evaluate the utility of these methods for their ability to estimate crop yields, severity of water stress and crop phenological development; and (3) to determine the feasibility of using crop temperature as a guide for irrigation scheduling. Crop temperatures were measured with an infrared thermometer, with attached leaf thermocouples and with airborne multispectral scanners. Corn and sorghum were the principal crops studied. Some data were also obtained for soybeans and alfalfa. Results of the studies suggest that crop temperature data can be used to assess crop water status. As such, crop temperature data can be used for scheduling irrigation, for detecting and monitoring effects of limited availability of water to crops, for evaluating the effectiveness of various irrigation scheduling techniques, for examining the uniformity of water application by various irrigation systems, for detecting soil areas with low water holding capacities, and as a means to select plant types which are most effective in tolerating or avoiding shortages of water.
W81-01002

PROGRAM LAYOUT - AN INTERACTIVE PROGRAM TO HANDLE PAGE LAYOUT FOR DOCUMENTATION OF COMPUTER FILES PRINTED ON-LINE AT REMOTE TERMINALS,
National Hydrology Research Inst., Calgary (Alberta).
W. C. Horwood, and K. U. Weyer.
NHRI Report No 9, 1980. 60 p, 9 Tab, 5 Append.

Descriptors: *Computer programs, *Remote terminals, LAYOUT, Automatic printout, *Documentation, Program listings, Program outputs, Hydrologic data, *Publications, *Information retrieval, Programs.

The documentation of program listings and program outputs for reports and publications is a tedious and time consuming procedure subject to errors. It is best done automatically using the files and the facilities of the computer itself. Computer files, however, are generally stored as continuous streams of information. Printing of these files at terminals produces continuous and unstructured listings, which are very laborious to read. In theory, the final structure of the listings and the layout of the printing faces can be fully anticipated at the time of programming. This, however, has proven to be a complicated, cumbersome and time-consuming procedure. All of these disadvantages can be efficiently overcome by using a general purpose program to structure automatically for printing by the computer any computer listing, program input or output stored on magnetic files. To the best knowledge of the authors, program LAYOUT is the first general program of this kind. The design of the page layout for the final printing is prepared interactively at a remote terminal. Automatic printing of the final structured file is also routed to remote terminals to avoid some of the disadvantages of main printers of computers such as their automatic response to formatting commands often included in program output. (WATDOC)
W81-01015

USE OF GEOPHYSICAL LOGS TO ESTIMATE WATER-QUALITY TRENDS IN CARBONATE AQUIFERS,
Geological Survey, Denver, CO. Water Resources Div.
L. M. MacCary.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-224124, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-57, 1980. 23 p, 8 Fig, 2 Tab, 18 Ref.

Descriptors: *Logging(Recording), *Borehole geophysics, *Water quality, *Electric well logging, *Radioactive well logging, Aquifer characteristics, Carbonate rocks, Resistivity, Porosity, Analytical techniques, Evaluation, Montana, North Dakota, South Dakota, Wyoming, Apparent water resistivity.

The water quality in carbonate aquifers can be determined by analysis of resistivity and porosity logs. When supporting data from water analyses are available, the value of the cementation exponent m can be determined more precisely. Data for this study were taken from logs of oil-test wells, Amstrat sample studies, drill-stem tests and water test wells in parts of Montana, North and South Dakota, and Wyoming. The preferred resistivity curves for apparent water resistivity (Rwa) analyses are the deeply focused laterolog and the induction log. The standard electric log can be used if the drilling mud is not saturated with salt. The preferred porosity logs are the sonic, sidewall neutron, compensated neutron, and the density logs. Older, uncalibrated neutron curves can be empirically calibrated in some instances, however, resulting porosities are frequently anomalous when compared to those determined from core or modern logs. When apparent water resistivity is determined for many wells, the data can be plotted and contoured to outline areas of recharge, direction of probable ground-water movement, and location and salinity of brine areas. (USGS)
W81-01029

AERIAL INFRARED PHOTOGRAPHY FOR FLOOD PLAIN INVESTIGATIONS,
Institute of Hydrology, Wallingford (England).
K. Blyth, and G. P. Nash.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 5, p 425-434, 1980. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Flood profiles, *Aerial photography, *Infrared radiation, Flood data, Mapping, Films, Color, Thames River(England).

Flood mapping from low-cost aerial photographs reduces demands on staff resources, improves the quality and quantity of flood data, and provides a visual record of the flood plain. Light aircraft is used and both vertical and oblique photographs are taken with 35 mm cameras. The effectiveness of the system was evaluated in a series of flights over

the flooded Thames in February 1977, and in a study of the Rivers Lee and Roding upper catchments in May 1978. The total cost of the Thames project was 6.25 British Pounds Sterling per km including interpretation and mapping. The oblique, color infrared aerial photographs, taken up to a week after maximum flood extent, were an effective method of mapping maximum flood extent. (Small-FRC)
W81-01055

DEVELOPMENT OF A MODEL FOR ESTIMATING THE EXTENT OF RIVER FLOODING WITH SATELLITE AND IN SITU DATA,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
W. R. Philipson, J. N. McLeester, and W. R. Hafker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-152035, Price codes: A05 in paper copy, A01 in microfiche. Project Technical Completion Report, November, 1980. 26 p, 7 Fig, 3 Tab. OWRT-A-089-NY(1), 14-34-0001-0134.

Descriptors: *Remote sensing, *Satellites(Artificial), *Flood forecasting, Data processing, *Model studies, River basins, Aerial photography, Photogammetry, New York, *Black River basin(NY), *Landsat, *Multispectral scanner data, *Image analysis.

The value and use of Landsat satellite data for obtaining information on flooding were assessed in this study of the Black River Basin in northern New York. The investigation had three parts. Initially, the reliability of delineating flood-affected areas from Landsat data was established by comparison with flood boundaries derived from aerial photographs of a different but similar flood. Secondly, it was established that the delineation of flood-affected areas could be performed through visual analysis of band 7 (near-infrared) Landsat images as reliably as it could through color-additive viewing or digital analysis using all Landsat bands or scenes of different dates (flooding and no flooding). Lastly, a preliminary predictive model was developed which uses in situ measurements of river discharge to estimate the extent of flooding. This model was derived by statistically relating in situ measurements of discharge to Landsat-derived measurements of the area and location of flooding.
W81-01203

7C. Evaluation, Processing and Publication

FISCAL 1980 ANNUAL REPORT TO OFFICE OF WATER RESEARCH AND TECHNOLOGY, USDI.
Pennsylvania State Univ., University, PA. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 6E.
W81-01004

STATISTICAL ANALYSES OF SURFACE-WATER-QUALITY VARIABLES IN THE COAL AREA OF SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-01023

WATER RESOURCES DATA FOR MONTANA, WATER YEAR 1979.
Geological Survey, Helena, MT. Water Resources Div.
Geological Survey Water-Data Report MT-79-1, July, 1980. 842 p, 10 Fig, 5 Tab.

Descriptors: *Montana, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for Montana consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 226 gaging stations; stage only records for 1 lake station; stage and contents for 9 lakes and reservoirs; water quality for 137 stations, 3 lakes; and water levels for 23 observation wells. Also included are 172 crest-stage partial-record stations and 43 smaller reservoirs. Additional water data were collected at various sites, not part of the systematic data-collection programs, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Montana. (USGS)
W81-01039

WATER RESOURCES DATA FOR PUERTO RICO, WATER YEAR 1977, SURFACE AND QUALITY-OF-WATER RECORDS AND GROUND WATER RECORDS.
Geological Survey of Puerto Rico, San Juan. Water Resources Div.
Geological Survey Water-Data Report PR-77-1, July, 1980. 204 p, 19 Fig, 3 Tab, 25 Ref.

Descriptors: *Puerto Rico, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water-resources data for surface-water, quality-of-water, and ground-water records for 1977 water year for Puerto Rico consist of records of discharge, water quality of streams, and water levels of wells. This report contains discharge and water-quality records for 35 gaging stations, 74 water-quality stations, and water levels for 58 observation wells. Also included are data for 17 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and the Commonwealth of Puerto Rico. (USGS)
W81-01040

WATER RESOURCES DATA FOR PENNSYLVANIA, WATER YEAR 1979--VOLUME 1. DELAWARE RIVER BASIN.
Geological Survey, Harrisburg, PA. Water Resources Div.
Geological Survey Water-Data Report PA-79-1, September, 1980. 297 p, 12 Fig, 3 Tab

Descriptors: *Pennsylvania, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Delaware River basin(PA).

Water resources data for the 1979 water year for Pennsylvania consist of records of discharge and water quality of streams, contents of lakes and reservoirs, and water levels of ground-water wells. This report, Volume 1 (Delaware River basin), contains records for water discharge at 73 gaging stations, contents at 11 lakes and reservoirs, water quality at 39 gaging stations and water levels at 16 observation wells. Also included are data for 43 crest-stage, 28 low-flow, and 43 water-quality partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection programs and are published as miscellaneous measurements and analyses. These data together with the data in Volumes 2 and 3 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Pennsylvania. (USGS)
W81-01042

GEOLOGY AND GROUND WATER IN NORTH-CENTRAL SANTA CRUZ COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. J. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113243, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-26, September, 1980. 33 p, 7 Fig, 3 Tab, 37 Ref.

Descriptors: *Groundwater potential, *Aquifer characteristics, *Groundwater availability, *Water quality, *California, Hydrogeology, Geohydrologic units, Test wells, Groundwater recharge, Evaluation, *Santa Cruz County(CA).

North-central Santa Cruz County is underlain mainly by folded sedimentary rocks of Tertiary and Cretaceous age that have been highly fractured by movements in the San Andreas fault system. Ground water is stored in fractures within shale and mudstone formations and in intergranular pore spaces within fine- to very fine-grained sandstone and siltstone formations. Fewer than 10% of the wells yield more than 15 gallons of water per minute. The water in most wells is moderately hard to very hard, is generally of a sodium bicarbonate or calcium bicarbonate type, and commonly has excessive concentrations of iron or manganese. Of the many geologic units in the study area, only the Purisima Formation of Pliocene age has the potential to sustain well yields greater than 100 gallons per minute. (USGS)
W81-01044

THIRD-ORDER INTEGRAL RELATION BETWEEN SORPTIVITY AND SOIL WATER DIFFUSIVITY USING BRUTSAERT'S TECHNIQUE,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
For primary bibliographic entry see Field 2G
W81-01076

WATER RESOURCES DATA FOR WASHINGTON, WATER YEAR 1979--VOLUME 1. WESTERN WASHINGTON.
Geological Survey, Tacoma, WA. Water Resources Div.
Geological Survey Water-Data Report WA-79-1, October, 1980. 433 p, 22 Fig.

Descriptors: *Washington, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Western Washington.

Water Resources data for the 1979 water year for Washington consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 237 gaging stations, stage only at 5 gaging stations, stage and contents at 43 lakes and reservoirs, water quality at 135 gaging stations (including 6 lakes and reservoirs) and 100 wells, and water levels at 164 observation wells. Also included are data for 88 crest-stage, and 89 water-quality partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Washington. (USGS)
W81-01176

WATER RESOURCES DATA FOR WASHINGTON, WATER YEAR 1979--VOLUME 2. EASTERN WASHINGTON.
Geological Survey, Tacoma, WA. Water Resources Div.
Geological Survey Water-Data Report WA-79-2, October, 1980. 314 p, 19 Fig

Descriptors: *Washington, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment

transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Eastern Washington.

Water Resources data for the 1979 water year for Washington consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 237 gaging stations, stage only at 5 gaging stations, stage and contents at 43 lakes and reservoirs, water quality at 135 gaging stations (including 6 lakes and reservoirs) and 100 wells, and water levels at 164 observation wells. Also included are data for 88 crest-stage, and 89 water-qualtiy partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Washington. (USGS)
W81-01177

WATER RESOURCES DATA FOR MISSOURI, WATER YEAR 1979.
Geological Survey, Rolla, MO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-220478, Price codes: A14 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MO-79-1, October, 1980. 320 p, 3 Fig.

Descriptors: *Missouri, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for Missouri consist of records of stage, discharge, and water quality of streams; stage, contents of water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 119 gaging stations, stage only at 3 gaging stations, stage and contents at 6 lakes and reservoirs, and water quality at 32 gaging stations (including 1 lake) and 3 wells. Also included are data for 114 crest-stage, and 11 water-quality partial-record stations. (USGS)
W81-01178

WATER RESOURCES DATA FOR WEST VIRGINIA, WATER YEAR 1979.
Geological Survey, Charleston, WV. Water Resources Div.
Geological Survey Water-Data Report WV-79-1, August, 1980. 417 p, 4 Fig.

Descriptors: *West Virginia, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for West Virginia consist of records of stage, discharge, and water quality of streams and springs; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 117 gaging stations, stage only records for 8 gaging stations, stage and contents for 7 lakes and reservoirs, contents for 1 reservoir, change in contents for 1 reservoir, water quality for 92 gaging stations, and water levels for 34 observation wells. Also included are 2 crest-stage partial-record stations, and 1 low-flow partial record station. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in West Virginia. (USGS)
W81-01179

A STATISTICAL ANALYSIS OF THE QUALITY OF SURFACE WATER IN NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
R. A. Engberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-227895, Price codes: A13 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-43, June, 1980. 277 p, 14 Fig, 9 Tab, 19 Ref.

Descriptors: *Water quality, *Surface waters, *Chemical analysis, *Biological properties, *Nebraska, Streamflow, River basins, Sampling, Sites, Water analysis, Equations, Regression analysis, Correlation analysis, Specific conductivity, Planning, Water quality control.

This report provides descriptive statistics for 29 chemical or biological constituents for 109 stream sites in Nebraska sampled by the U.S. Geological Survey beginning in 1946. Also provided for each site are regression equations relating specific conductance to each of 12 chemical constituents and a regression equation relating specific conductance to stream discharge. The descriptive statistics are presented by river basins. Water leaving these basins that has the lowest mean specific conductance (266 umho/cm) is from the Niobrara River at Verdel, and water that has the highest (1,890 umho/cm) is from the South Platte River at Roscoe. Statewide, the principal cations in streamflow are calcium and sodium, and the principal anions are bicarbonate and sulfate. Calcium and bicarbonate usually predominate where mean specific conductance is less than 1,000 umho/cm, and sodium and sulfate predominate where the mean exceeds 1,000 umho/cm. Based on regression equations, dissolved solids, hardness, calcium, magnesium and bicarbonate, with some exceptions, correlate well with specific conductance for all stream sites. Illustrations of how regression equations may be used to estimate water quality of streamflow are given and are compared with values from actual analyses. (USGS)
W81-01180

GROUND-WATER LEVELS IN NEW MEXICO, 1977,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. D. Hudson.
New Mexico State Engineer Basic Data Report, 1980. 131 p, 35 Fig, 56 Tab.

Descriptors: *Groundwater resources, *Observation wells, *Water level fluctuations, *Water utilization, *New Mexico, Hydrologic data, Basic data collections, Aquifers, Bibliographies, Groundwater, Publications.

Water levels are measured periodically in a network of about 5,000 observation wells to record changes in groundwater storage. About 1,000 wells are measured annually and the remaining 4,000 wells are scheduled to be measured at 5-year periods, staggered so that a portion are measured each year. The areas of water-level observation are within seven of the nine major surface-water drainage basins; most are in areas where groundwater is used in large quantities for irrigation, municipal, or industrial purposes. Water-level measurements were made in January or February 1978. Intensive-coverage measurements were made in the Animas and Lordsburg valleys, Playas basin, and Carlsbad area. Tables of water-level data for these areas show change in water levels for 1973-78. Maps showing 5-year water-level changes for the four areas are also included. A bibliography of papers and publications pertaining to groundwater in New Mexico and adjacent areas published or released to the open file in 1977, with additions from 1848-1976 is included. (USGS)
W81-01181

WATER-QUALITY MONITORING OF THREE MAJOR TRIBUTARIES TO THE CHESAPEAKE BAY--INTERIM DATA REPORT,
Geological Survey, Towson, MD. Water Resources Div.
D. J. Lang, and D. Grason.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113888, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-78, September, 1980. 66 p, 1 Fig, 5 Tab, 9 Ref.

Descriptors: *Water quality, *Basic data collections, *Water analysis, *Rivers, *Chesapeake Bay, Bays, Sampling sites, Sediment transport, Sediments, Bottom sediments, Nutrients, Trace elements, Pesticides, Herbicides, Insecticides, Potomac River, James River(VA), Susquehanna River(MD).

The U.S. Geological Survey is monitoring the water quality of three major tributaries to the Chesapeake Bay at their fall lines in order to obtain estimates of constituent inputs potentially available to the Bay. The monitoring sites are: Susquehanna River at Conowingo, MD.; Potomac River at Washington, DC.; and James River at Cartersville, VA. Water-quality data collected from October 1978 to April 1980 are presented in tabular format. Concentrations of major ions, nutrient and carbon species, metals, pesticides, suspended sediment, and other selected constituents are presented for a range of flows. The mean, standard deviation, minimum, maximum, and median values for each constituent were determined by standard methods and are presented for each sampling station. Bivariate linear regressions were run for all constituents versus streamflow, specific conductance, and suspended sediment. Those relationships exhibiting coefficients of determination greater than 0.50 are tabulated. (USGS)
W81-01184

MAPS SHOWING SATURATED THICKNESS, JANUARY 1979, AND PERCENTAGE DECREASE IN SATURATED THICKNESS, 1950-79, OF UNCONSOLIDATED AQUIFER, WEST-CENTRAL, KANSAS,
Geological Survey, Garden City, KS. Water Resources Div.
M. E. Pabst.
Geological Survey Open-File Report 79-1340, December, 1979. 3 p, 2 Plates, 5 Ref.

Descriptors: *Maps, *Unconsolidated aquifers, *Kansas, Groundwater, Aquifer characteristics, Water wells, Water yield, Irrigation, Water levels, Withdrawal, *West-central Kansas, *Ogallala Formation, Saturated thickness.

The principal water-yielding formation (unconsolidated aquifer) supplying water to wells in west-central Kansas is comprised of the Ogallala Formation and undifferentiated Pleistocene deposits. About 1,860 square miles of the area are underlain by sufficient saturated material to supply groundwater for irrigation. Saturated thickness in the area ranges from less than 50 feet to about 270 feet. Thickness of saturated deposits in the unconsolidated aquifer in west-central Kansas has decreased as a result of groundwater withdrawals, principally for irrigation. From 1950 to 1979, the decrease in saturated thickness was negligible in some areas and as much as 80 feet in other areas. The decrease, in a few areas, was nearly an 80% reduction of the initial (1959) saturated thickness. (USGS)
W81-01195

8. ENGINEERING WORKS

8A. Structures

OFFSHORE WATER INTAKES DESIGNED TO PROTECT FISH,
Stone and Webster Engineering Corp., Boston, MA. Hydrology Div.
For primary bibliographic entry see Field 6G.
W81-01070

MADE TO MEASURE,
D. Morris.

Group 8A—Structures

Water and Waste Treatment, Vol 23, No 8, p 26, 29, August, 1980.

Descriptors: *Construction materials, *Materials engineering, *Specifications, *Construction, *Fabrication, *Design data, *Structural shapes, Technology, Design standards, Tunnel linings, Costs, Dimensions, Structural steel, Structural analysis, Water tanks, Pipelines, Sewage treatment, Industrial water.

Vessels used for water production, effluent treatment and for other industrial purposes are now being designed and manufactured from a variety of materials to meet specific requirements for modular treatment plants. The basic materials used for tanks are mild steel, stainless steel, aluminum, titanium, glass reinforced resins, and thermoplastics. A variety of lining materials suitable for each tank are also available. Equipment to treat and control industrial effluent is available from separate commercial manufacturers. Commercial contracts for the design and installation of a modular water production plant and an effluent treatment plant are described. Modular treatment plants have wide application; they are efficient, fabricated in suitable materials, and readily available from commercial manufacturers. (Titus-FRC)
W81-01074

NEW WAYS TO FIX LEAKY SEWERS,
RJN Environmental Associates, Inc., Wheaton, IL.
R. E. Nelson.
American City and County, Vol 95, No 9, p 39, 40, 42, September, 1980.

Descriptors: *Sewers, *Repairing, Manholes, Pipes, *Maintenance, Infiltration, Rates, Sliplining, Materials.

A rehabilitation program undertaken in Streamwood, Illinois to update the sewage system called for sliplining 1546 feet of 24-inch diameter sewer, rehabilitating 991 out of 1154 manholes in the system, grouting leaky sewer lines, replacing cracked sewer lines, and disconnecting 850 private sector sources of inflow. These procedures have largely been completed with a resulting 50 to 70% reduction in infiltration/inflow. Sewer backups are greatly reduced, and building permits in the community are no longer restricted. Most of the system's 255,000 lineal feet of sanitary sewer were vitrified clay pipe. About 80% of the 1154 manholes were precast concrete, and the rest were concrete block. The replaced 1546 feet of pipes were severely cracked due to root intrusion through defective joints and other factors. Sliplining was performed using a polyethylene pipe with an outside diameter of 22.05 inches and a wall thickness of 1.248 inches. To replace and reseal the frame grade adjustments to manholes, the manhole was hand excavated to the cone section. Frame and grade adjustments were removed and the surface of the cone section was cleaned for preparation of a gasket material. A flexible rubber-like gasket was placed around the entire circumference of the cone section at about the midpoint of the wall. Precast concrete ring grade adjustment of the frame was placed on top of the gasket material, forming a water-tight seal. (Baker-FRC)
W81-01102

8B. Hydraulics

PILOT SCALE EVALUATION OF PHYSICAL-CHEMICAL WASTEWATER TREATMENT SYSTEM FOR COMBINED SEWER OVERFLOWS.
Pollutech Pollution Advisory Services Ltd., Oakville (Ontario).
Environmental Protection Service, Ottawa, Ontario, Canada. Canada-Ontario Agreement on Great Lakes Water Quality Research Report No 36, 1976. 96 p, 27 Fig, 29 Tab, 19 Ref.

Descriptors: *Sewerage, *Wastewater treatment *Sewer outfalls, Microstrainers-ozonation system, Stormwater drainage, Dry weather flow, Hydraulic loading, *Great Lakes, Water quality, Physical-chemical treatment, *Sewer overflows, Design criteria.

This report describes a pilot scale investigation of the feasibility of using coarse screening, microscreening, and ozonation for the treatment of combined sewer overflows. The pilot scale system consisted of a Crane-Cochran Microstrainer with 23 micron screen openings and an ozone generator. During the first part of the study, the pilot unit was installed at the West Oakville Water Pollution Control Plant. The dilute waste concentrations anticipated in combined sewer overflows were simulated by diluting raw sewage with tapwater. The contaminants measured were BOD, total organic carbon, suspended solids, total phosphorus, oil and grease, and total coliforms. The effects of waste strength and hydraulic loading were studied by varying the dilution of the raw waste and controlling the throughput of the unit. (WATDOC)
W81-01020

8G. Materials

MADE TO MEASURE,
For primary bibliographic entry see Field 8A.
W81-01074

8I. Fisheries Engineering

FISH MANAGEMENT AND PROTECTION,
Oregon Department of Fish and Wildlife, Portland.
F. R. Young.
In: Conflicts Over the Columbia River, Seminar conducted by Water Resources Research Institute, Oregon State University, Corvallis, Spring Quarter 1980. Report SEMIN WR 028-80, July, 1980, p 29-32.

Descriptors: *Columbia River, *Fish management, *Fish migration, *Aquatic habitats, *Fish hatcheries, Dams, Spawning, Dam sites, Rainbow trout, Salmonids, Diversion structures, Water management(Applied).

The decline of salmon and steelhead in the Columbia River can be linked with man's industrially based economy, which is in direct competition with the habitat requirements of these fish. Logging and streamside road-building have produced siltation of spawning beds, low summer stream flows and high temperatures from lack of streamside cover. All reduce the streams' productivity. Main-stem dams have blocked large areas of the Columbia and changed it from a free-flowing river to a series of lakes. Problems associated with these dams include a delay in migration due to a slowing of the river, predation as a result of increased exposure time, and residualism wherein the fish will not arrive at the ocean when they are physiologically prepared to and thus remain in the reservoirs. The loss of adults may exceed 20% at some dams with juvenile loss even higher. Resource management agencies are waging a battle to save the fish runs. The logging industry is using buffer strips and restricting road-building along streams as well as using helicopters to log steep areas. Grazing allotments have been reduced on public lands and a few streams have been fenced to prevent livestock abuse. Irrigation diversions have been screened to keep downstream migrants from becoming fertilizer for farmer's crops. The Corps of Engineers has also spent millions on bypass systems at main-stem Columbia and Snake River dams. With these and other improvements, the runs can probably survive until hatcheries can be brought into full production over the next 10 to 20 years. (Atkins-Omniplan)
W81-01012

WATER QUALITY OF THE COLUMBIA RIVER,
Environmental Protection Agency, Seattle, WA Water Div.
For primary bibliographic entry see Field 5C
W81-01200

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

PROGRAM LAYOUT - AN INTERACTIVE PROGRAM TO HANDLE PAGE LAYOUT FOR DOCUMENTATION OF COMPUTER FILES PRINTED ON-LINE AT REMOTE TERMINALS,
National Hydrology Research Inst., Calgary (Alberta).
For primary bibliographic entry see Field 7B.
W81-01015

10D. Specialized Information Center Services

MANUAL OF PRACTICE ON URBAN DRAINAGE.
Environmental Protection Service, Ottawa (Ontario). Water Training and Technology Transfer Div Canada-Ontario Agreement on Great Lakes Water Quality Research Report No 104, 1980. 326 p, 67 Fig, 48 Tab, 71 Ref.

Descriptors: *Urban drainage, *Water quality, *Water pollution effects, *Sewage systems, Drainage systems, Surface runoff, Flow characteristics, Source controls, Storage facilities, Storm water management, Treatment facilities, Evaluation, Administration, Controls, Laws, *Great Lakes, Planning, Design criteria, Urban drainage manual.

This manual presents planning and design concepts, analytical and design methodologies, and technological alternatives for prevention and abatement of problems related to the quantity and quality of storm runoff from developed urban areas and areas undergoing urban development. Solutions to these problems are identified and depend on planning, design, and operation of sanitary, storm, and combine sewage systems. This manual is not a 'design manual' containing the information needed to plan and design urban drainage systems Rather, it is intended as a presentation of the concepts which can be used to derive solutions to the problems. The manual consolidates the research and development findings of the Urban Drainage Subcommittee program of the Canada-Ontario Agreement as well as information from other Canadian programs and work conducted in other countries, especially the United States, related to storm and combined sewage control. This manual addresses the following specific objectives: To identify the seriousness of urban drainage problems; to identify and describe new effective solutions to urban drainage problems; to present urban drainage problems and solutions in a framework of inter-agency cooperation; to achieve urban storm water management; and to contribute to the achievement of the general and specific water quality objectives for the Great Lakes that have been agreed upon by the governments of Ontario and Canada. (WATDOC)
W81-01021

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 14, NUMBER 8
APRIL 15, 1981

W81-01204 -- W81-01425
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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

VOLUME 14, NUMBER 8
APRIL 15, 1981

W81-01204 -- W81-01425

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

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PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

DETERMINATION OF DEUTERIUM/HYDROGEN RATIOS IN NATURAL WATERS BY FOURIER TRANSFORM NUCLEAR MAGNETIC RESONANCE SPECTROMETRY,
Hong Kong Univ. Dept. of Chemistry.
For primary bibliographic entry see Field 7B.
W81-01244

MASS SPECTROMETRIC DETERMINATION OF DEUTERIUM IN WATER AT NATURAL LEVELS,
Australian Atomic Energy Commission Research Establishment, Lucas Heights.
For primary bibliographic entry see Field 5A.
W81-01246

2. WATER CYCLE

2A. General

HAWAIIAN GROUNDWATER GEOLOGY AND HYDROLOGY, AND EARLY MATHEMATICAL MODELS,
Hawaii Univ., Honolulu. Water Resources Research Center.
J. F. Mink, and L. S. Lau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157117, Price codes: A05 in paper copy, A02 in microfiche. Technical Memorandum Report No 62, September, 1980. 74 p, 11 Fig, 3 Tab. OWRT-A-077-HI(1), 14-34-0001-9013.

Descriptors: *Aquifer characteristics, *Hydrogeology, *Groundwater, *Mathematical models, Confined aquifers, Unconfined aquifers, Convection-transport phenomena, Basalts, *Hawaii, Hydraulic conductivity, Basalts, Extrusive rocks, Intrusive rocks, Ghyben-Herzberg lens, Tidal efficiency.

This report is comprised of four papers: (1) Composition and Hydrologic Character of Hawaiian Rocks, (2) Hydrologic Behavior of Hawaiian Ghyben-Herzberg Lens, (3) Critique of Early Mathematical Models, and (4) Bottom Storage: A Review of its Origin and Evolution and a Critique of its Validity. The first paper evaluates and summarizes the existing information pertaining to the hydrologic properties, including hydraulic conductivity of Hawaiian basaltic rock. The second paper evaluates and summarizes the existing factual information pertaining to the behavior of Hawaiian basal (Ghyben-Herzberg) lens. The third paper is a critique of three early mathematical groundwater models: Hoyt's mechanical testing, Wentworth's statistical correlation, and TEMPO's numerical model. The fourth paper is an assessment of Wentworth's concept on bottom storage of a thick lens. The intent of this series of papers is to provide an evaluated summary of important data, concepts, and methodologies developed in Hawaii over the many decades with particular reference to the unusual hydrologic and geologic volcanic and oceanic environments. These publications and unpublished material are scattered and generally not evaluated; many of them are not readily available. The four papers are an attempt to fill this information gap.
W81-01376

2C. Snow, Ice, and Frost

ICE SHEET FORMATION FROM DEPOSITED SNOW IN HIGHLY ACIDIC LAKE KATANUMA,
National Inst. for Environmental Studies, Yatabe (Japan).
K. Satake.
Japanese Journal of Limnology, Vol 41, No 2, p 68-74, April, 1980. 6 Fig, 2 Tab, 9 Ref.

Descriptors: *Ice-water interfaces, *Lake ice, *Ammonia, Nutrients, Ice cover, *Acidic water, Melt water, Snow, Lake Katanuma, Japan.

The mechanism of alternate milky ice and firm ice formation on the highly acidic Lake Katanuma (Japan) was investigated. The chemical constituents of the ice sheets and the snow in the area were similar, as were the chemical constituents of the water layers found between the ice layers and the lake water. There were chemical differences between the water and ice layers. It is suggested that first the lake water freezes, then snow is deposited on the ice sheet. The ice sheet may sink slightly under the weight of the snow, causing the water to penetrate the underside of the deposited snow. The content of ammonia in the snow and ice sheets (1.06-3.56 microgram-at/liter) was comparable to the maximum level found in the lake in April and July. These results suggest that the supply of ammonia from melted snow and ice is one of the main sources of nitrogen nutrients in the lake. (Small-FRC)
W81-01264

A COMPARATIVE STUDY OF MICROWAVE RADIOMETER OBSERVATIONS OVER SNOWFIELDS WITH RADIOACTIVE TRANSFER MODEL CALCULATIONS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
A. T. C. Chang, and J. C. Shiue.
Remote Sensing of Environment, Vol 10, No 3, p 215-229, November, 1980. 12 Fig, 1 Tab, 18 Ref.

Descriptors: *Data collection, *Snowpacks, *Water sources, Water equivalent, Instrumentation, Remote sensing, Snow, Water cycle, Measurement, Radiometer, Snowmelt, Melt water, Water yield, Water supply, Runoff forecasting.

A truck-mounted microwave system experiment performed to study the microwave emission characteristics of snowpacks in the Colorado Rocky Mountain region during 1977-1978 is described. Spectral signatures of 5.0, 10.7, 18, and 37 GHz radiometers with dual polarization were measured, together with observations of snowpack density and temperature profiles, ram profile, and free water content. Data thus collected compare favorably with results calculated from microscopic scattering techniques. Variations in the snow accumulation and snow metamorphosis appeared as variations in passive microwave brightness temperatures observed by the truck-mounted radiometer. For a relatively homogeneous snowpack the microwave brightness temperatures for various microwave frequencies may be calculated with an accuracy of 5-10 K by a simple scattering model. This uncertainty translates into a 2.5-5 cm error in snow depth estimates and a 0.6-1.25 cm error in water equivalent estimates. The presence of melt water in the snowpack drastically changes the microwave emission characteristics, resulting in as much as a 50 K increase in brightness temperature over a dry cross section snow condition. The only information which it is possible to glean from that situation would be that the snowpack is in the process of melting. (Baker-FRC)
W81-01283

MODIFICATION OF THE TIDE IN THE CANADIAN ARCTIC BY AN ICE COVER,
Department of Fisheries and Oceans, St. John's (Newfoundland).
G. Godin.
Manuscript Report Series No 56, 1980. 29 p, 8 Fig, 5 Tab, 7 Ref.

Descriptors: *Arctic, *Ice cover, *Tides, *Water level fluctuations, *Canada, Bays, Straits, Climatic zones, Cold regions, Bodies of water, Surface waters, Regions, Ice, Climatology, Ice breakup, Ice-water interfaces, Water levels, Correlation analysis, Variability, Research and development, Evaluation, Harbors.

Objective criteria were sought for verification that ice cover might modify the tide in the arctic. Those tested were comparisons between: predicted tide at a local site and the observed water level (or the latter at an ice-free harbor and the local level); the mean time internal between lunar transit and local occurrence of high/low water; the power spectrum of the observed levels in various frequency bands and tide range (height difference between high and low water). None of these criteria provided an unequivocal answer. Together they indicated that the tide is unmodified at sites in good contact with the deep ocean, but modified at sites removed from the open ocean by shallows or in deep recesses of water bodies (Hudson Bay). Also, ranges appeared higher during open water and the tide arrival time was changed. Lake Harbour in Hudson Strait is unaffected; Coral Harbour and Churchill exhibit larger and later tides during the open water season. It was concluded that a seasonal change in the character of the Canadian arctic tide is a function of geography and does not affect stations lying around the perimeter of the ocean or connected to it by deep channels. (Zielinski-IPA)
W81-01412

2D. Evaporation and Transpiration

CROP WATER SUPPLIED BY CONTROLLED AND REVERSIBLE DRAINAGE,
Science and Education Administration, Florence, SC. Coastal Plains Soil and Water Conservation Research Center.
C. W. Doty.
Transactions of the ASAE, Vol 23, No 5, p 1122-1126, 1130, October/Novermber, 1980. 3 Fig, 2 Tab, 11 Ref.

Descriptors: *Irrigation practices, *Controlled drainage, Consumptive use, Permeability, Corn, Evapotranspiration, Soil moisture, Drainage, Soil-water-plant relationships, *Irrigation efficiency.

Corn was grown for 3 seasons on a 1.7 hectare plot using the controlled and reversible drainage system (CaRD). This method, useful in sandy loam soils with poor drainage during wet periods, was applied in this study to a moderately permeable soil not normally used for CaRD. Evapotranspiration data was determined. The estimated soil water storage was compared with the measured data obtained from tensiometer and suction release curves. These figures agreed closely enough so that it was possible to measure the water consumption of the corn crop for the 3-year period. Estimated irrigation needs were less than the water actually supplied by the CaRD system in 1975 and 1976, more in 1977. Although 1975 and 1976 crops were adequately irrigated, the 1977 crop did not receive sufficient water. Soil permeability was a limiting factor, evaportranspiration rates were very high, and tile spacings were too far apart for the climatic conditions. The CaRD system must be carefully designed if used in soils with permeability less than 3.0 meters per day because tile spacings would have to be closer than 15 m in hot, dry years. (Cassar-FRC)
W81-01277

2E. Streamflow and Runoff

STOCHASTIC GENERATION OF ANNUAL STREAMFLOWS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W81-01369

2F. Groundwater

MEASUREMENT OF DEPTH TO WATER TABLE IN A HEAVY CLAY SOIL,
Soil Survey Inst., Wageningen (Netherlands).
J. Bouma, L. W. Dekker, and J. C. F. M. Haans.
Soil Science, Vol 130, No 5, p 264-270, November, 1980. 4 Fig, 19 Ref.

Descriptors: *Water table, *Analytical techniques, *Tensiometers, Boreholes, Clays, Measurement, Piezometry, Soil water, Instrumentation, Groundwater basins, Depth, Potentiometric level, Soil water movement, Water level recorders.

The depth to water table was determined in spring in heavy clay soils using different techniques that would allow a physical evaluation of the process involved and determination of the most desirable procedures to be used in the future. The clay soils studied were at different locations in the riverine area along the Rhine River and until about 60 yr ago had been used extensively as meadows. They were classified as Typic Fluvaquents (very fine clayey, mixed, mesic). Methods of measurement included: a 1.2-m deep perforated pipe; two series of shallow, unlined boreholes to depths of 30 and 50 cm below the surface; and one series of piezometers to 30 cm. Pressure potentials were measured in duplicate by transducer tensiometry at 10-cm depth intervals. Different water levels were noted in the unlined boreholes at the shallow depths, while pressure potentials in surrounding soil were negative. Such water levels do not qualify as water tables, but result from preferential movement of water along larger continuous voids in the shallow holes while soil mass itself is unsaturated. It was concluded that small-diameter, shallow, unlined boreholes should not be used to determine depth to water table in clay soils that have preferential pathways for water movement. A series of piezometers at different depths would give acceptable results. A series of tensiometers is particularly valuable, as it allows determination not only in saturated, but also under unsaturated conditions. Deep, unlined boreholes with a small diameter yielded acceptable values in these experiments. (Baker-FRC)
W81-01279

HAWAIIAN GROUNDWATER GEOLOGY AND HYDROLOGY, AND EARLY MATHEMATICAL MODELS,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 2A.
W81-01376

2G. Water In Soils

DETERMINING IMPACT OF IRRIGATION ON GROUNDWATER,
Youngstown State Univ., OH. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W81-01370

SIMULATION OF FLOW PATTERNS AND ION-EXCHANGE IN SOIL PERCOLATION EXPERIMENTS. PART I. TRACER EXPERIMENTS AND FLOW MODEL,
Norsk Inst. for Vannforskning, Oslo.
K. Brustad, and A. Njos.
Water, Air, and Soil Pollution, Vol 13, No 4, p 459-472, December, 1980. 8 Fig, 16 Ref.

Descriptors: *Mathematical models, *Percolation, *Soil water movement, Flow measurement, Model studies, Soil moisture, Tracers, Radioisotopes, *Ion exchange.

A model to study the complex flow of water in soils was developed, using the concepts of the residence time theory, and using tritiated water as a tracer in humus. These models and experimental techniques will ultimately be applied to the study of natural systems. Tracer response curves were obtained with input in the form of a step function and as a short pulse. Both methods showed similar patterns, but a smoother residence time distribution curve was obtained from the pulse response technique. Observed residence time distribution curves showed that the commonly used simple axial dispersion model is not adequate to describe the flow. Results show that 2 types of flow occur in soil systems: rapid throughflow in large to medium-sized pores and very slow flow in smaller pores. The model is mathematically simple and easy to solve with a computer, and provides a good basis for subsequent models of a more complicated nature. (Cassar-FRC)
W81-01415

2H. Lakes

RESULTS OF A LIMNOLOGICAL STUDY OF LAKE POCASSE, SOUTH DAKOTA,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 5C.
W81-01238

ATTACHED AND PLANKTONIC ALGAL COMMUNITIES IN SOME INSHORE AREAS OF GREAT BEAR LAKE,
Alberta Environmental Center, Vegreville.
J. W. Moore.
Canadian Journal of Botany, Vol 58, No 21, p 2294-2308, 1980. 5 Fig, 7 Tab, 60 Ref.

Descriptors: *Algae, *Great Bear Lake(Canada), *Plankton, *Lakes, Sessile algae, Aquatic microorganisms, Aquatic plants, Standing crops, Aquatic algae, Canada, Alberta(Canada).

Species composition and standing crop of algae were determined in three areas of Great Bear Lake, Canada, during the summers of 1976-1978. Since this large, remote lake will eventually be subject to industrial development, it was desirable to determine background information to assess changes in environmental quality. Species composition and standing crop were similar in all three collection areas, because water chemistry and temperature were relatively uniform throughout the lake. Species commonly found in the epilithon were Tabellaria flocculosa, Achnanthes minutissima, and Ulothrix zonata. In the epipelon the most important species were Gyrosigma spenceri, Nitzschia obtusa, Cocconeis placentula, Amphora ovalis, and Achnanthes lanceolata. Maximum densities occurred in August or September, as follows: epilithon, 1,950,000 cells per square cm; epipelon, 4,000,000 cells per square cm. Plankton standing crops reached a maximum of 233 million to 301 million cells per cubic meter by September. Dominant species were Dinobryon bavaricum, Dinobryon sociale, Rhodomonas minuta, Cyclotella species Synedra acus var. radians, and Ankistrodesmus falcatus. All algae counts were among the lowest on record for freshwaters. Although available nutrients approach world average levels, low temperatures and violent summer storms are believed responsible for the small algae populations. Epilithon populations are different from other large North American Lakes. Epipelic compositions are similar to lakes in the western Arctic and different from lakes in Precambrian Canada and Scandanavia. (Cassar-FRC)
W81-01253

APPLICATIONS OF LANDSAT DATA FOR ESTIMATING PHYTOPLANKTON PRODUCTION IN LAKE CHAD (AFRICA). (APPLICATION DES DONNEES LANDSAT A L'ESTIMATION DE LA PRODUCTION DU PHYTOPLANCTON DANS LE LAC TCHAD),
Institut National de la Recherche Agronomique, Thonon-les-Bains (France).
J. Lemoalle.
Hydrobiologie, Vol 13, No 1/2, p 35-46, 1979-80. 9 Fig, 2 Tab, 31 Ref.

Descriptors: *Lakes, *Phytoplankton, *Aerial photography measurement, Reflectance, Chlorophyll, Optical properties, Remote sensing, Eutrophication, Lake Chad(Africa), *Africa, Landsat.

Lake surface radiance as measured by the Landsat satellite can be used to estimate the phytoplankton distribution and production when relationships between water transparency and chlorophyll are known. The conditions for the use of such satellite data, and application of the technique to Lake Chad (Africa) in 1975, are described. Mean gross production values in the open waters of the southern basin of the Lake Chad (an area of 1500 sq km) were estimated at 3.76 g 02 per sq m per day on June 22, 1975, and 0.91 g 02 per sq m per day on October 8, 1975. The corresponding ranges of chlorophyll concentration in mg of chlorophyll per cu m were 4-197 on June 22 and 0.8-14 on October 8. (Small-FRC)
W81-01262

MEASUREMENTS OF UNDERWATER SPECTRAL IRRADIANCE IN LAKE BIWA,
Kinki Univ., Osaka (Japan). Faculty of Agriculture.
R. Tsuda.
Japanese Journal of Limnology, Vol 41, No 2, p 57-67, April, 1980. 9 Fig, 2 Tab, 16 Ref.

Descriptors: *Lakes, *Optical properties, *Light quality, Opacity, Turbidity, Light intensity, Light penetration, Color, Coasts, Lake Biwa, Japan.

Secchi disk depths, beam attenuation coefficients, downward spectral irradiance, water color, and optical characteristics of the natural light field were investigated in Lake Biwa (Japan). Due to sometimes intense light absorption by suspended particulate solids, yellow suspended substances, and the water itself, both sides of the visible region of the downward spectral energy distribution were remarkably attenuated. The peaks in the spectral distribution were at about 560 nm in the south basin and at about 540 nm in the southern part of the north basin. Both basins were basically turbid coastal waters. The south basin and the north basin corresponded to optical water types 5 and 3, respectively, in Jerlov's optical classification scheme. In the lake, the value of KV (illuminance) times ZSD (Secchi disk depth) was 1.49, and the depth to which 1% of the surface illumination penetrated was 2.7 times as large as the Secchi disk depth. (Small-FRC)
W81-01265

LIMNOLOGICAL STUDIES ON INORGANIC ACID LAKES IN JAPAN (IN JAPANESE),
National Inst. for Environmental Studies, Yatabe, (Japan).
K. Satake.
Japanese Journal of Limnology, Vol 41, No 1, p 41-50, January, 1980. 1 Fig, 87 Ref. (English abstract).

Descriptors: *Acidic water, *Limnology, *Lakes, Fish, Zooplankton, Phytoplankton, Algae, Bacteria, Water chemistry, Reviews, Japan.

A review is presented of studies of inorganic acid lakes in Japan. Lake Katanuma (1915) and Lake Onumaike (1920) were the first lakes to be investigated. The typology of acid lakes was first investigated by Ueno. The biota of acid lakes was investigated by several researchers, who found Pinnularia braunii in Lake Katanuma, Brachionus urceoralis in Lake Ichibishinaiko, Leptodictyum and fish in Lake Osoresanko, and other algae, zooplankton and insects in various acid lakes. Anzai found that the deposition of iron compounds was followed by the occurrence of Pinnularia braunii. Studies made after World War II included investigations of the chemical composition of Lake Yugama, mold and bacteria in acid lakes, phytoplankton and zooplankton in the Kirishima lakes, and macrophytes and fish in Lake Osoresanko. Total CO2 and CO2 uptake in oxic and anoxic water was measured in Lake Katanuma, and the mechanism of sulfur-diatom lamination was clarified. Changes in biota caused by the acidification of Lake Tazawako and Lake Toyako were determined. (Small-FRC)
W81-01266

PHOSPHORUS RELEASE FROM SEDIMENTS FROM LAKE CARL BLACKWELL, OKLAHOMA,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
M. H. Bates, and N. J. E. Neafus.
Water Research, Vol 14, No 10, p 1477-1481, October, 1980. 4 Fig, 2 Tab, 19 Ref.

Descriptors: *Phosphorus, *Lakes, *Sediments, Aerobic, Anaerobic, Mixing, Sterility, Microorganisms, Dissolved oxygen, Bacteria, Lake Carl Blackwell(OK), Oklahoma.

A study was conducted in the laboratory to determine the effects of anaerobic vs aerobic conditions, sterile vs non-sterile conditions and mixing on the

release of soluble ortho-phosphate from sediments obtained from Lake Carl Blackwell, Oklahoma. Investigations were carried out for a 30-day experimental period utilizing eight laboratory systems which reflected the various combinations of the three specified environmental conditions. Phosphate release under non-sterile conditions exceeded the release observed under sterile conditions in all systems. Phosphate release in mixed systems exceeded the release in static systems in all conditions investigated. Anaerobic release of phosphates was greater than aerobic release in all except two cases. (McKeon-FRC)
W81-01339

A THREE-DIMENSIONAL FIELD EVALUATION AND ANALYSIS OF WATER QUALITY IN TWO RESERVOIRS,
Tennessee Technological Univ., Cookeville. Dept. of Civil Engineering.
J. A. Gordon, and S. A. Wells.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157083, Price codes: A08 in paper copy, A01 in microfiche. Tennessee Water Resources Research Center, University of Tennessee, Knoxville, Research Report No 79, August, 1980. 148 p, 27 Fig, 20 Tab, 120 Ref. OWRT-A-054-TENN(2), 14-34-0001-0145.

Descriptors: *Reservoirs, *Water quality, *Mathematical models, Theoretical analysis, Diffusion, Dispersion, Mixing, Physical properties, Lake morphology, Biological properties, Chemical properties, Data collections, Tennessee, *Center Hill Lake(TN), *Cherokee Lake(TN).

In formulating mathematical models for reservoir water quality, simplifying assumptions are often made with regard to the geometry of the model. For many lake and reservoir models, the assumptions of one-dimensionality (i.e., water quality changes are significant only in one dimension-usually depth), as well as two-dimensionality (considering the length and depth of the water body), have been utilized to predict water quality. In both cases, the assumption of lateral homogeneity is made. A field study was undertaken to determine the change of water quality in the lateral dimension. The main study reservoir was Center Hill Lake in Middle Tennessee. Data were also obtained for Cherokee Lake in East Tennessee. Several water quality parameters were analyzed over the length, breadth, and depth of these reservoirs from pre-stratification through post-stratification: temperature, dissolved oxygen, pH, conductivity, oxidation-reduction potential. The statistical and theoretical three-dimensional analysis showed the expected variation for each water quality parameter in each direction. The influence of the lateral dimension on water quality management and modeling was found to be negligible.
W81-01377

2J. Erosion and Sedimentation

SEDIMENT PRODUCTION OF ALLUVIAL CHANNELS IN RESPONSE TO BASE LEVEL LOWERING,
Geological Survey of Israel, Jerusalem.
Z. B. Begin, D. F. Meyer, and S. A. Schumm.
Transactions of the ASAE, Vol 23, No 5, p 1183-1188, October/November, 1980. 9 Fig, 3 Tab, 15 Ref.

Descriptors: *Base level, *Sediment discharge, *Alluvial channels, *Drainage, Running waters, Sediment load, Suspended solids, Mathematical models, Sediment transport.

An experimental study of the degradation of alluvial channels in response to base level lowering was carried out in flumes 15 meters and 20 meters long at slopes of 1%. Sediment discharge was measured and a power function decay of sediment discharge with time with an exponent close to -0.5 was noted. An equation was developed from the data to describe sediment discharge. Variables included mean width and initial constant slope of the channel and amount of base level lowering. Channel armoring, which produced an abrupt decrease in sediment discharge, was a prominent effect during the runs. The equation was extended by computer simulation to a simple drainage net. Location of tributaries had a marked effect on the amount of sediment produced as a function of base lowering. (Cassar-FRC)
W81-01269

CHARACTERISTICS OF ERODED SEDIMENT.
Science and Education Administration, Morris, MN.
R. A. Young.
Transactions of the ASAE, Vol 23, No 5, p 1139-1142, 1146, October/November, 1980. 3 Fig, 3 Tab, 32 Ref.

Descriptors: *Sedimentology, *Soil aggregates, *Erosion, Sediment sorting, Slopes, Soil erosion, Particle size.

Eroded sediments are characterized to develop guidelines to use in sediment prediction models. Data from the literature and from unpublished recent studies are reviewed and summarized. Soil particle detachment and transport depends on particle size distribution, density, and degree of aggregation of the matrix soil. Clay and silt aggregates in the 20 to 200 micrometers range are more erodible than larger or smaller particles. Very sandy soils, not well aggregated, erode as primary particles, with the sediment particle size distribution similar to that of the matrix. Soils composed of greater than 50% sand or clay produce sediment with particles larger than 50 micrometers. High clay soils form a considerable amount of sediment particles larger than 1000 micrometers. Soils high in silt produce sediment largely in the 20 to 35 micrometer range. Aggregate density averages about two thirds that of primary particles and varies inversely with the amount of silt in the soil. Vegetative cover affects the particle size of eroded material, generally increasing fines and decreasing coarse particles as cover increases. However, tillage practices affect these relationships and should be further studied. Percentage of coarse material (greater than 50 micrometers) transported increases with slope up to 10%, then remains constant to the highest level tested, 32%. (Cassar-FRC)
W81-01275

SAND BED INSTABILITY DUE TO BED LOAD MOTION,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
H. Nakagawa, and T. Tsujimoto.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY12, p 2029-2051, December, 1980. 13 Fig, 1 Tab, 25 Ref.

Descriptors: *Model studies, *Movement, *Bed load, Flow rates, Stochastic processes, Sand bars, Dunes, Waves, Sediments, Suspended solids, Sand waves, Geology, *Sediment transport, Sediment load, Fluctuations, Hydraulics.

Previous research has illustrated that the lag of sediment transport for bed form has a great impact on sand bed instability. As of yet this lag has not successfully been quantitated. The present study seeks to clarify the role and constitution of the lag by examining the instability analysis and comparing it with theories on the process of bed load transport rate. The applicability of this model was verified by devised experiments using a movie camera and a film motion analyzer. The flow model based on potential flow theories has been improved by taking into account the effect of flow acceleration or deacceleration, which may be represented by local fluctuations in flow depth. This allows estimations of the phase lag between bed shear stress and bed form to be made. Investigations into the relationships between bed surface instability and hydraulic conditions were also carried out. Results confirmed those of previous investigators, but no added information was gained on the formation of antidunes migrating downstream. (Geiger-FRC)
W81-01368

2K. Chemical Processes

PROCESS AND PLANT FOR THE RECOVERY OF WATER FROM HUMID AIR,
Maschinenfabrik Augsburg-Nuernberg (Germany, F.R.). (Assignee).
W. Bulang.
U.S. Patent No 4,197,713, 4 p, 2 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 792, April 15, 1980.

Descriptors: *Patents, *Meteoric water, *Water vapor, Precipitable water, Humidity, Adsorption, Heat exchangers, Condensation, Heat, Equipment.

A process and a plant for the recovery of water from humid air are disclosed. Humid ambient air flows through an adsorber in which an adsorbing agent removes moisture from the air by adsorption. Subsequently, air heated by an air heater and delivered by a fan flows through the adsorber in order to recover by desorption the moisture. Then the water vapor containing air is precooled in a counterflow heat exchanger and subsequently conducted into a condenser in which heat is extracted from it by means of a heat pump so that the water vapor condenses and is available in the form of liquid water. The air cooled and dried in the condenser is utilized in the counterflow heat exchanger for precooling the air fed into the condenser. The heat given off by the heat pump is supplied to the air heater in order to be utilized for heating the air flowing through the air heater. (Sinha-OEIS)
W81-01425

2L. Estuaries

THE SIGNIFICANCE OF THE ENTRAPMENT ZONE LOCATION TO THE PHYTOPLANKTON STANDING CROP IN THE SAN FRANCISCO BAY-DELTA ESTUARY,
Water and Power Resources Service, Sacramento, CA.
J. F. Arthur, and M. D. Ball.
Report, November, 1980. 101 p, 28 Fig, 6 Tab, 38 Ref.

Descriptors: *Estuaries, *Phytoplankton, *Standing crops, *Euphotic zone, California, Diatoms, Settling velocity, Inflow, Chlorophyll, Inorganic compounds, Nutrients, Water chemistry, Specific conductivity, *San Francisco Bay-Delta Estuary.

A study conducted during the summer of 1978 in the upper San Francisco Bay-Delta Estuary of California further supported the theory that phytoplankton standing crops are highest when the entrapment zone is adjacent to the expansive shallows of Suisun Bay. The photic zone in the shallows of Suisun Bay constitutes a greater percentage of the total depth than in the channels. The entrapment zone was maintained in Suisun Bay from mid-July through October 1978 by regulating Delta outflow through operational control of the Federal and State water projects. Maximum phytoplankton concentrations occurred when the tidally averaged position of the entrapment zone was in the vicinity of Honker Bay. Delta outflows of 140 to 230 cubic m/s were required to maintain the entrapment zone in this location. Forty-one species of phytoplankton were identified, with the diatom Thalassiosira excentricus being the most numerous. The settling rate of T. excentricus is nearly equal to the maximum net upward vertical velocity in the water column. The settling of the diatom from the downstream-flowing surface layer into the upstream-flowing bottom layer is the theorized mechanism by which these organisms are concentrated in the entrapment zone. High chlorophyll concentrations, as well as the lowest inorganic nitrogen and orthophosphate levels, were observed in water with specific conductances of 5-14 millimho/cm. Results indicate that the phytoplankton standing crop in Suisun Bay can be regulated, within water availability limits, by manipulating Delta outflow to optimize the entrapment zone location. (Moore-SRC)
W81-01225

Group 2L—Estuaries

REEXAMINATION OF THE WATER CHEMISTRY AND PLANKTOLOGY OF A DELAWARE TIDAL STREAM AS RELATED TO ITS FLUSHING CHARACTERISTICS,
Delaware Univ., Newark. Coll. of Marine Studies.
F. C. Daiber, E. M. Simek, and M. Van House.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157091, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware Technical Completion Report, November, 1980. 57 p, 16 Fig, 3 Tab, 44 Ref, 3 Append. OWRT-A-044-DEL(1), 14-34-0001-0108.

Descriptors: *Zooplankton, *Water chemistry, Water quality, Hydrography, *Delaware Bay, Estuaries, Sewage pollution, Flushing time, Tidal streams, Nutrients, *Tidal effects, *Murderkill River estuary.

In the early 1970's, the zooplankton communities of the Murderkill and Broadkill Rivers were investigated and found to be different. At that time, the Murderkill was an unperturbed system whereas the Broadkill received considerable point source pollution. It was concluded that water quality degradation in the Broadkill was responsible for the observed differences in the zooplankton communities. Since 1973, the Kent County Regional Sewage Treatment Plant (STP) has been discharging nutrients and biodegradable material into the Murderkill River. Based on the earlier study, it was predicted that the zooplankton community in the Murderkill would since have shifted toward that which was found in the Broadkill. The present investigation, a reexamination of the water quality and zooplankton community of the Murderkill, was conducted to test this hypothesis. Statistical comparisons of water quality data between the previous and present studies show that water quality has changed since the STP began operating. Ammonium and nitrite concentrations have increased significantly below the plant, and dissolved oxygen has decreased. Phosphate and nitrate concentrations increased both upstream and downstream of the plant. Changes in chlorphyll-a concentrations were inconclusive. In general, the composition of the zooplankton community has remained relatively stable since the STP began operations. Specific changes in species composition associated with the water quality degradation on the Broadkill River did not occur on the Murderkill, nor were there any of the changes associated in the literature with the classic conditions of eutrophication.
W81-01375

MODIFICATION OF THE TIDE IN THE CANADIAN ARCTIC BY AN ICE COVER,
Department of Fisheries and Oceans, St. John's (Newfoundland).
For primary bibliographic entry see Field 2C.
W81-01412

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3C. Use Of Water Of Impaired Quality

EXTENDED USE OF TREATED MUNICIPAL WASTE WATER BY THE BUCKEYE IRRIGATION COMPANY: A DOCUMENTATION OF EFFECTS,
Arizona Water Resources Research Center, Tucson.
C. B. Cluff, T. C. Tucker, A. D. Day, J. A. McFadyen, and P. G. Sebenik.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156630, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, September, 1980. 29 p, 6 Fig, 19 Tab, 3 Ref, 2 Append. OWRT-A-050-ARIZ(4), 14-31-0001-5003.

Descriptors: *Waste water disposal, *Municipal wastes, Irrigation water, *Irrigation practices, *Cost-benefit analysis, Farm prices, Irrigation programs, Irrigation systems, Irrigated land, Irrigation efficiency, Water utilization, Waste water treatment, Environmental sanitation, Nitrates, Groundwater, Profit, Water costs, Water sources, Water supply, *Water reuse, Arizona.

The treated effluent use by the Buckeye Irrigation Company is the largest in the State of Arizona. It is unique in that it is used by an irrigation district. This two-year study addressed three objectives: (1) identify changes during an extended period of application of treated waste water to irrigated fields (in irrigation and fertilization practices, cropping patterns, crop yield response/equality, irrigation water quality, and soil properties); (2) make a preliminary evaluation of the effects of effluent use on groundwater conditions; and (3) make a preliminary evaluation of changes in water costs and farm profits. Most of these initial objectives were achieved. Groundwater nitrate concentration showed an accelerating increase possibly due to continued use of fertilizer practice during waste water use. In general, more nitrate-nitrogen was deposited on pump water irrigated fields than on fields irrigated with waste water-pump water mixtures, while the latter provided higher total nitrogen due to waste water organic nitrogen. Pump-waste water use generated considerably less total soluble salts and about 4 parts-per-million phosphorus. Little or no change occurred in irrigation or fertilization practices, or in cropping patterns. Waste water use varied from 100% in winter to about two-thirds of the crop demand in the summer. (Zielinski-IPA)
W81-01208

TREATMENT AND DISPOSAL OF SUGARBEET PROCESSING WASTE WATER BY IRRIGATION,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
J. H. Smith, and C. W. Hayden.
Science and Education Administration, Department of Agriculture, Conservation Research Report No 25, September, 1980. 59 p, 3 Tab, 32 Ref, 1 Append.

Descriptors: *Irrigation, *Waste water treatment, *Waste water disposal, *Food processing industry, Industrial wastes, *Water reuse, Flood irrigation, Idaho, Alfalfa, Grasses, Soil chemistry, Soil water, Water chemistry, Nitrates, Chemical oxygen demand.

Irrigation with sugarbeet processing waste water was studied at three locations in Idaho for 2 or 3 years where perennial grass and alfalfa were irrigated by flooding specially graded fields. Experimental sites were scheduled for irrigation at intervals of 1, 2, or 4 weeks. The weekly irrigated plots were discontinued after 1 year because of excess loading. Waste water samples from the sugar factories and water samples extracted from the soil at depths of from 15 to 150 cm were analyzed for chemical oxygen demand, total nitrogen, phosphorus, potassium, electrical conductivity, calcium, magnesium, sodium, sodium absorption ratio, pH, chlorine, sulfate, and bicarbonates. Soil and plants were also analyzed for selected constituents. Water applications range from 28 to 201 cm/year and chemical oxygen demand applications ranged from 8 to 140 metric tons/hectare. Chemical oxygen demand reductions in the waste water at Twin Falls averaged 48% in winter and 98% in summer; at Rupert, it averaged 84% in winter and 98% in summer; and at Nampa, it averaged 75% in winter and 88% in summer. Nitrates found in water samples extracted from 150 cm in the soil were mostly below 10 parts per million. Irrigation with sugarbeet processing waste water works well in the field. (Moore-SRC)
W81-01220

DAIRY OPEN LOT AND LAGOON-IRRIGATED PASTURE RUNOFF QUANTITY AND QUALITY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
P. W. Westerman, and M. R. Overcash.
Transactions of the ASAE, Vol 23, No 5, p 1157-1164, 1170, October/November, 1980. 6 Fig, 13 Tab, 20 Ref.

Descriptors: *Farm wastes, *Agricultural runoff, *Rainfall-runoff relationships, Dairy industry, Pasture management, Farm lagoons, Nitrogen, Ultimate disposal, Waste water disposal, Water pollution, Runoff, *Irrigation water.

The quality and quantity of rainfall runoff from a dairy open lot and a pasture irrigated with water from dairy lagoon effluent (1 cm every other week) were determined. Over a 30-month period 21% of rainfall on the open lot became runoff and 10% on the pasture. Average nitrogen runoff yield was 234 kg per hectare-year in the lot and 24.8 kg per hectare-year in the pasture. Of 936 kg nitrogen per hectare applied to the pasture during a year, 2.6% was transported. Compared with previous data for beef feedlots and dairy lots of higher stocking density, nutrient concentrations in the lot were lower. Runoff concentrations from the pasture compared with data obtained elsewhere for plots receiving similar loadings of animal wastes. In general, concentrations of nitrogen, phosphorus, total organic carbon, and chloride were 4 to 6 times greater in the lot runoff than in the pasture runoff. (Cassar-FRC)
W81-01272

PRELIMINARY INVESTIGATIONS INTO THE EFFECTS OF REFINERY WASTE WATER, AND THE SINGLE EFFECT OF ITS MAJOR POLLUTANTS ON COMMERCIALLY INTERESTING CROPS,
G. A. Al-Nakshabandi, Z. Hameed, A. Abdulhadi, and B. Saleem.
Progress in Water Technology, Vol 12, No 3, p 109-117, 1980. 4 Fig, 2 Tab, 4 Ref.

Descriptors: *Crop response, *Industrial water, *Oil industry, Phenols, Oil, Barley, Corn, Alfalfa, Vegetable crops, Hydrogen sulfide, Ammonia, Refinery wastes, Irrigation practices, Water reuse.

The effects of refinery waste water and irrigation water containing NH3, H2S, oil, and phenol on commercial crops were investigated. Corn, barley, alfalfa, and radish were irrigated with solutions containing varying amounts of one of the pollutants, or with a dilution of API separator discharge from KNCP. Germination of the field crops was not affected by any of the pollutants; however, radish germination was retarded by 100% and 75% solutions of refinery waste water. Growth rates of radish, barley, and corn did not differ significantly from controls under all treatments. Alfalfa was affected. Thus, most crops tolerated the different types and concentrations of pollutants, except for heavily polluted waste water used in one test. (Small-FRC)
W81-01315

WASTE HEAT UTILIZATION THROUGH SOIL HEATING,
Cold Region Research and Engineering Lab., Fairbanks, AK.
T. McFadden, and J. Buska.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 105-117. 8 Fig, 1 Tab, 13 Ref.

Descriptors: *Alaska, *Cold regions, *Agricultural enhancement, *Soil heating, Powerplant cooling water, Plant growth, Crop response, Crops, Vegetable crops, Beans, Lettuce, Sweet corn, Ice fog, Growing season, Cooling water, Water reuse.

Warm cooling water discharged from the Fort Wainwright powerplant near the University of Alaska was used for agricultural enhancement by soil heating. Despite long hours of daylight, the growing season in the far north is severely restricted by cold soil temperatures. Warmer soil allows the growth of several warm season crops not normally possible in Alaska, and increased yield on crops normally grown. Two test plots and a control plot were prepared. The test plots had buried heating pipes that used 2,000 gallon per minute of diverted power plant cooling water. The diverted

water had a temperature range of 10 to 38C. Results of harvested crops show that the heated plots outproduced the unheated control plot in every case except for one species of lettuce. Crops tested include sweet corn, broccoli, cauliflower, lettuce, spinach, beans, peas, and zucchini. Increased crop yields as high as 425% were obtained with corn and multiple harvests were possible with some crops. An added advantage of this use of waste heat from powerplant cooling water is the reduction of the ice fog caused during the winter months in the vicinity of cooling ponds. (See also W81-01381) (Seigler-IPA)
W81-01386

3D. Conservation In Domestic and Municipal Use

MONO LAKE, CALIFORNIA: SAVING A LAKE OR SERVING A CITY,
Wisconsin Univ.-Madison. Dept. of Geography.
T. R. Vale.
Environmental Conservation, Vol 7, No 3, p 190-192, Autumn, 1980. 2 Fig, 1 Tab, 13 Ref.

Descriptors: *Water utilization, *Los Angeles aqueduct, *Water conservation, Lakes, Irrigation, Potable water, Environmental effects, Aqueducts, Migratory birds, Waterfowl, Aquatic life, Water demand, Water resources development, Surface water availability, Saline lakes, Water quality.

Completion of the Los Angeles Aqueduct in 1913 caused the level of the Mono Lake waters since then to drop by about 15 meters. The surface area of the lake has decreased by nearly 50%, and an island in the lake which supports nesting California gulls has connected with the mainland, exposing the colony to predation. Los Angeles officials insist that the present water use rate from the aqueduct is necessary to serve the domestic needs of the residents of the city. Environmentalists fear that decreased water levels will cause fluctuations in lake populations of brine shrimp and brine flies, which form an important part of the diet of migratory and nesting birds of the Mono Lake area. Several environmental groups have endorsed plans to reduce water exports from the lake to 18 million cubic meters per year. This would constitute a reduction of 110 million cubic meters of water per year, or 14% of the water supply now consumed by the 3 million residents of Los Angeles. Much more water is used for agricultural irrigation than for domestic purposes. Recent studies have shown that water demand often depends on water availability, and voluntary practices of water conservation by Southern California residents have yielded decreases in water consumption greater than that which would have resulted from imposed rationing. Discussions on the more efficient use of urban water supplies are included. (Geiger-FRC)
W81-01255

WATER AND ENERGY CONSERVATION ALTERNATIVES FOR THE NORTH,
Environmental Protection Service, Edmonton (Alberta).
J. J. Cameron, and B. C. Armstrong.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 47-88. 5 Fig, 10 Tab, 32 Ref.

Descriptors: *Northwestern Territories, *Canada, *Cold regions, *Water conservation, Public health, Education, Toilets, Showers, Bathing, Hot water, Plumbing, Economic efficiency, Water demand, Water consumption, Water reuse.

A comprehensive study conducted by the Government of the Northwestern Territories shows that water use can be significantly reduced by public education. Prudent application and acceptance of water conservation methods can improve the level of service and sanitation in northern areas more rapidly than earlier thought possible. Extensive tables and discussion are given on toilet modification alternatives, toilet alternatives, bathing alternatives, laundry alternatives, and miscellaneous water conservation alternatives. Toilets use more water than any other home fixture. The economics of various water conservation devices is determined by the reduction in water demand and energy costs for hot water heating. An analysis of a four-person household recommends a dual flush and dam toilet, low flow shower heads, front load washers, and insulated hot water pipes. Recommendations vary according to the type of water supply system used, either a piped system or a trucked system. Since the cost of trucked service is directly related to water consumption, a reduction in demand will change the economic attractiveness of such trucked systems. (See also W81-01381) (Seigler-IPA)
W81-01384

3F. Conservation In Agriculture

YIELD RESPONSE OF CORN RELATED TO SOIL MOISTURE,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
R. V. Morey, J. R. Gilley, F. G. Bergsrud, and L. R. Dirkzwager.
Transactions of the ASAE, Vol 23, No 5, p 1165-1170, October/November, 1980. 3 Fig, 6 Tab, 12 Ref.

Descriptors: *Corn, *Crop response, *Irrigation practices, Soil moisture, Soil-water-plant relationships.

The response of corn to sprinkler irrigation was studied for 3 seasons, 1973-1975, on a Hubbard loamy sand at Elk River, Minnesota. The 4 treatments in 1973 were scheduled on a moisture depletion basis as follows: no irrigation, and irrigation when soil moisture dropped to 25%, 50%, and 75%. The irrigated crop yield was about twice the nonirrigated crop yield, but there was little variation in results among the 3 irrigation treatments. The 1974 and 1975 treatments were based on fixed intervals and amounts of water. Corn yield was poor in the nonirrigated treatment and was greater with increasing amounts of water applied. Gravimetric soil moisture measurements were used to further validate a soil moisture budget model. Computed and measured moisture contents agreed well. This model provided estimates of transpiration ratio and yield response functions. (Cassar-FRC)
W81-01274

CROP WATER SUPPLIED BY CONTROLLED AND REVERSIBLE DRAINAGE,
Science and Education Administration, Florence, SC. Coastal Plains Soil and Water Conservation Research Center.
For primary bibliographic entry see Field 2D.
W81-01277

MULTIPLE CHAMBER DRIP IRRIGATION HOSE,
W. A. Delmer.
U.S. Patent No 4,196,853, 8 p, 14 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 2, p 507, April 8, 1980.

Descriptors: *Patents, *Irrigation, *Application equipment, Irrigation efficiency, Irrigation practices, Irrigation operation and maintenance, *Drip irrigation.

A multiple chamber drip irrigation hose has a primary and at least one secondary tube of flexible, water-impermeable material and is joined at a common wall. The common wall has a series of first holes placing the interior of the primary tube in communication with the interior of the secondary tube. The secondary tube has a series of second holes leading from the interior of the secondary tube to the exterior. A flexible filamentary line, ridge or groove is positioned within the secondary tube and forms a restricted path for water flowing from a first hole to a second hole. The apparatus compensates for varying pressures in the water supply and will automatically flush or blow out each time the water is turned on. (Sinha-OEIS)
W81-01417

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

TEMPORARY DETENTION CUTS STORM FLOW PEAKS,
Metropolitan Sanitary District of Greater Chicago, IL.
A. Talhami.
Civil Engineering-ASCE, Vol 50, No 12, p 72-75, December, 1980.

Descriptors: *Storm runoff, *Storm drains, *Urban hydrology, Storm sewers, Water storage, Urban runoff, Weirs, Cities, Stormflow, Sewers, Intakes, Pipes, Detention reservoirs, Pondage, Storage.

Methods of providing on-site temporary detention of stormwater runoff are discussed. These are useful in the design of urban drainage systems, for reducing peak rates of discharge from storm sewers. All designs are based on inflow in excess of outflow. They are sited upstream from any physical constraints such as culverts, and have a peak discharge which is limited by the hydraulic capacity of the constraints. Methods include detention basins, ponds, detention lakes, parking lots, underground structures, roof storage, crushed stone beds and surface storage in open spaces. Controlled release rates can be achieved by designing pipes with smaller diameters and by installing roof restrictors, weirs, and outlet structures in the middle of ponds. Such detention facilities are gaining increased acceptance as flood control measures. (Titus-FRC)
W81-01254

HYDROLOGIC INVESTIGATION, DESIGN, AND CONSTRUCTION OF FLOOD CONTROL STRUCTURES, COPPERHILL, TENNESSEE,
Dames and Moore, Denver, CO.
U. Kappus, C. L. Zimmerman, and T. Turner.
Mining Engineering, Vol 32, No 10, p 1504-1509, October, 1980. 6 Fig, 1 Tab, 14 Ref.

Descriptors: *Dam design, *Flood control, *Safety, Construction, Diversion, Hydrograph analysis, Conduits, Mining, Tennessee.

A project is described which was designed to divert flood flows of the North Potato Creek from the Cherokee ore body (Copperhill, Tennessee). Hydrologic studies were performed, and hydrographs were developed for possible floods. Computer simulations were performed for required dam height and overflow tunnel diameter. The project consisted of: a 28 m dam and a 9 m outlet conduit, an emergency spillway, and a 4 m diameter hard rock transbasin diversion tunnel. Design studies consisted of: site conditions, laboratory testing of soils and rock, embankment design, internal drainage, outlet conduit, and emergency spillway. Construction of the project is described. The flood management system is part of the Cities Service Co. mine safety program for the Cherokee ore body, which is partically located within the creek channel. (Small-FRC)
W81-01301

WATERCOURSE IMPROVEMENT STRATEGIES FOR PAKISTAN,
Colorado State Univ., Fort Collins.
J. O. Reuss, G. V. Skogerboe, and D. J. Merrey.
Water Supply and Management, Vol 4, No 5/6, p 409-422, 1980. 2 Fig, 2 Tab, 21 Ref.

Descriptors: *Water conveyance, *Water policy, *Pakistan, Water management, Water loss, Irrigation canals, Water conservation, Estimated costs, Planning, Water institutions, Watercourse improvement.

Losses of water from Pakistan's more than 80,000 watercourses reach at least 35-45%. Seepage and visible leaks from unimproved channels are a

major source of these losses. A combination of three major strategies for improvement is recommended. The cheapest method, at a cost of 33 rupees per acre foot and minimum investment, is heavy cleaning and maintenance, which involves removal of excessive vegetation and rebuilding banks. A second strategy entails lining channels with brick and mortar in areas of heavy traffic and water loss. Cost estimates are 70 rupees per acre foot. The third method, completely and properly lined channels, can save 95% of water losses at a cost of 124 rupees per acre foot and a large initial investment. These three methods may be used in combination, considering that the value of water saved in each locale determines the logical conservation method. The authors favor a decentralized administrative organization with local farmers participating in decisions and construction programs. A possible practical approach for reducing water losses in Pakistan courses would be immediate wide-scale implementation of the cleaning and maintenance strategy and formation of local Water Users Associations. More extensive improvements should be made where water costs and benefits justify them. (Cassar-FRC)
W81-01334

AQUATIC WEED CUTTER,
E. R. Donnelley.
U.S. Patent No 4,196,566, 8 p, 14 Fig, 15 Ref; Official Gazette of the United States Patent Office, Vol 993, No 2, p 410, April 8, 1980.

Descriptors: *Patents, *Water control, *Aquatic weeds, *Aquatic weeds, *Aquatic weed control, Equipment, Channels, Channel improvement, Weed cutter.

An aquatic weed cutter for cutting aquatic plants and root systems includes a water vehicle having a drive system connected to at least two shafts that project out of the vehicle. Each shaft has a circular cutting blade mounted at the distal end of the shaft. The cutting blades are positioned for rotation in a generally vertical plane for cutting as well as for propelling the vehicle through the water. The drive system is also used to control the position of the shafts below the surface of the water in order to position the tips of the cutting blades at various distances below as well as above the surface of the water bed. The shafts are positioned from one another in order to provide an overlapping relationship between each cutting blade. A forward cleaning blade is placed forward of each of the cutting blades with teeth having leading and trailing pitched portions to keep the cutting blades clean of debris. (Sinha-OEIS)
W81-01416

4B. Groundwater Management

INDIGENOUS RESOURCES AND WATER SUPPLY MANAGEMENT,
International Labour Organization, Geneva (Switzerland). Employment and Development Dept.
M. I. Hussain.
Water Supply and Management, Vol 4, No 4, p 201-219, 1980. 1 Fig, 6 Tab, 28 Ref.

Descriptors: *Irrigation programs, *Employment, *Water supply development, *Egypt, Manpower, Labor, Future planning, Water resources development, Water management, Equipment, Irrigation design, Crop production.

Arguments are presented which support the contention that provisions of irrigation increase job opportunities by expanding agricultural potentials and by utilizing manpower to work on irrigation system construction and maintenance. Irrigation has been shown to affect labor use by increasing cropping intensity, allowing shifts in crop patterns, and encouraging farmers to use high yield varieties. The work generating processes involved in preparing land for successful irrigation include leveling of land, digging of irrigation channels, and building of drainage systems. Each process is discussed with emphasis on its implementation in Egypt, along with manpower labor requirements. Small scale irrigation projects can generally be performed by unskilled laborers with locally manufactured equipment. Some small scale surface water and groundwater projects are discussed in relation to their ability to provide irrigation water and generate jobs. Although small scale projects are useful in serving immediate needs, they are often accused of being unreliable and of low quality, and of using inferior materials. The large-scale irrigation projects play an integral part in the economic growth of a nation. They are long term affairs employing more skilled employees, better technologies and more durable materials and equipment. To aid in deciding which type of labor intensive technology would be appropriate for developing countries, the World Employment Program has initiated a 'Development and application of appropriate technology for irrigation works' program. (Geiger-FRC)
W81-01329

DETERMINING IMPACT OF IRRIGATION ON GROUNDWATER,
Youngstown State Univ., OH. Dept. of Civil Engineering.
I. A. Khan.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 106, No IR 4, p 331-334, December, 1980. 9 Fig, 2 Tab, 23 Ref.

Descriptors: *Irrigation practices, *Agricultural engineering, *Environmental effects, Soil-water-plant relationships, Irrigation engineering, *Groundwater, Mathematical models, Groundwater resources, Irrigation systems, Arable land, Irrigation effects, Irrigable land, Water injury, Irrigation, Subsurface waters, Percolating water, Water table, Water quality.

Irrigation may adversely modify the soil and groundwater for the growth of most crops and eventually lead to the destruction of the irrigated system. However, careful planning and management may delay destruction. Salination is one symptom of potential destruction. A modeling procedure is described which inexpensively predicts groundwater quality as a result of present and future irrigation and agricultural practices. Specifically, the model predicts ionic distribution of irrigation return flows. It determines the effect of varying the leaching fraction on the quality of return flows and the effects of pumping and irrigation application schemes on the quality and quantity of groundwater. In addition, it predicts the effect of land use and cropping pattern changes on groundwater quantity and quality. (Titus-FRC)
W81-01370

4C. Effects On Water Of Man's Non-Water Activities

CHARACTERIZATION OF STORM RUNOFF IN LAS VEGAS VALLEY, NEVADA,
Nevada Univ. System, Reno. Water Resources Center.
J. W. Hess, and D. E. Zimmerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156663, Price codes: A04 in paper copy, A01 in microfiche. Publication No 41067, 1980. 57 p, 8 Fig, 6 Tab, 8 Ref. 5 Append. OWRT-A-084-NEV(1), 14-34-0001-8030.

Descriptors: *Storm runoff, *Salinity, *Urbanization, *Water quality, *Dissolved solids, Runoff, Rainfall intensity, Flash floods, Floods, Arid climates, Topography, Data collections, Las Vegas Valley basin(NV), Las Vegas(NV), *Nevada.

The total salinity of storm runoff is an important consideration. Public law 93-320 entitled the 'Colorado River Basin Salinity Control Act' has designated several sites, including Las Vegas Wash, for salinity control measures. A potentially significant salt load source is storm runoff. The purpose of this research was to develop background data on the chemical characteristics of storm runoff in Flamingo Wash, Las Vegas Valley. Seven runoff events were sampled at four sites along Flamingo Wash during the period of October 1977 through October 1978. Precipitation occurs from two types of events, both of which will produce runoff. Winter frontal storms produce large areas of low intensity rainfall, but can produce large totals. Summer precipitation results generally with precipitation amounts greater than 0.25mm with about 37% of these events being greater than 6.25mm. Approximately 15 thundershowers per year occur in the valley. Storm runoff from Flamingo Wash is apparently not an important source of salt loading to the Colorado system. In general, observed TDS during runoff events was less than 1000 mg/l.
W81-01205

REVIEW AND EVALUATION OF URBAN FLOOD FLOW FREQUENCY PROCEDURES,
Science and Education Administration, Beltsville, MD. Hydrology Lab.
W. J. Rawls, V. Stricker, and K. Wilson.
Bibliographies and Literature of Agriculture No 9, August, 1980. 65 p, 3 Tab, 1 Append.

Descriptors: *Flood flow, *Flood frequency, *Urbanization, *Model studies, Storm runoff, Urban runoff, Watersheds(Basins), Statistical models, Urban hydrology, Surface runoff, Rational formula, Mathematical studies, Urban drainage, Floods, Precipitation(Atmospheric).

Man's impact through urbanization causes a dramatic effect on the flood response of a watershed Usually, the introduction of impervious surfaces and improved drainage systems increases the amount of runoff and reduces flow travel times, producing a flood hydrograph of increased magnitude that is quicker to rise and recede. This report evaluates 128 published and unpublished papers (1962 to 1979) on urban flood flow frequency estimation procedures. The procedures are separated into three classes: statistical estimation of peak flow, single storm event, and continuous record. The literature does not adequately reflect what procedures are currently being used, but instead contains many articles on experimental models that have been designed for a specific region or a specific problem. Also, many of the single event and continuous record models reported were modified versions of previously reported models. Most of the models in the single event and continuous record categories could be applied regionally or nationally; however, no models in the statistical estimation of peak flow category, except perhaps the rational formula, had regional or national applicability. (Moore-SRC)
W81-01221

4D. Watershed Protection

EROSION BY CIRCULAR WALL JETS IN CROSS FLOW,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnam.
Journal of the Hydraulics Division Proceedings of the American Society of Civil Engineers, Vol 106, No 11, p 1867-1883, November, 1980. 12 Fig, 1 Tab, 15 Ref.

Descriptors: *Erosion rates, *Waste water disposal, Laboratory tests, *Turbulent flow, Effulents, Scour, Flow, Nozzles, Rivers.

The erosion caused by circular turbulent wall jets used to discharge effluents into rivers was examined. One jet with a diameter of 0.50 inch (12.7 mm) was evaluated in a wind tunnel using three weights of sand and one of polystyrene. A water-sand system was evaluated in the hydraulics laboratory using a 0.5 inch (12.7 mm) nozzle and sand. Equations are derived to estimate erosion under various conditions. A strong interaction was found between jet and cross flow. The maximum erosion was located nearer to the nozzle when there was cross flow. The profile of the eroded bed was similar if analyzed separately for the scour hole and ridge regions. (Small-FRC)
W81-01350

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

BACTERIOLOGICAL AND NUTRIENT STUDY OF MAJOR SURFACE WATERS IN BANFF NATIONAL PARK.
Inland Waters Directorate, Ottawa (Ontario).
Technical Report WQB-79-5, December, 1979. 60 p, 9 Fig, 13 Tab, 6 Ref, 1 Append.

Descriptors: *Surface waters, *National parks, *Water quality, *Canada, *Nutrients, *Aquatic microorganisms, Aquatic life, Recreation facilities, Natural resources, Facilities, Recreation, Water pollution, Water pollution sources, Lakes, Lagoons, Microorganisms, Analysis, Testing, Evaluation, Water analysis, Bacteria, Coliforms, *Banff National Park(Alberta).

The quality of surface waters in Banff National Park, located about 112 km west of Calgary in the eastern ranges of the Rocky Mountains, was studied in 1975 and 1976. The study documents the existing quality of a number of surface waters within the Park, and indicates that the quality of the Bow River, Louise Creek, Sunshine Creek, Forty Mile Creek, and the Spray River are degraded by human activities. Effluent releases from lagoons at Lake Louise and Banff were found to increase nutrient levels and bacteria populations in the Bow River. Louise Creek quality is impaired by effluent releases from the upper sewage lagoon and by discharge from the Chateau Lake Louise heating plant. Forth Mile Creek quality was adversely affected by effluent releases from the septic system serving the Banff Recreation Center. Septic wastes are now directed to the Banff townsite sewage system. Bacteriological counts showed that fecal material intermittently enters the low reaches of the Spray River from an unidentified source. Bow Lake and Lake Minnewanka had good quality with no apparent effect from lake shoreline development. Salmonella and Shigella pathogenic bacteria were absent in all study samples tested. (Zielinski-IPA)
W81-01212

SURFACE WATER QUALITY IN YOHO NATIONAL PARK - AN INVENTORY.
Inland Waters Directorate, Ottawa (Ontario).
Technical Report WQB-80-1, January, 1980. 24 p, 1 Fig, 5 Tab, 14 Ref, 1 Append.

Descriptors: *Surface waters, *Water quality, *Canada, *National parks, Anions, Cations, Aquatic microorganisms, Aquatic life, Facilities, Recreation facilities, Natural resources, Recreation, Water analysis, Ions, Electrolytes, Properties, Trace metals, Heavy metals, Water pollution, Microorganisms, Chemical analysis, Evaluation, Nutrients, *Yoho National Park(British Columbia).

The results of a two-year baseline monitoring program carried out in Yoho National Park, located in the heart of the Canadian Rockies, are presented and summarized. The study, which covered the period from April 1976 to March 1978, showed that while the Park waters are generally of good quality, Park areas exist where surface water quality has been degraded by human activites. Nutrient levels in all surface waters examined were typically low and did not appear to be elevated by activities within the Park. In decreasing abundances, the major cations were calcium, magnesium, sodium, and potassium; while the major anions were bicarbonate, sulfate, silicates, chlorides, and fluorides. The abundance of these ions were similar to those found in most Rocky Mountain Parks. Copper, cadmium, mercury, arsenic, selenium, lead, and barium were generally below/near detection limits in all streams. Measurable manganese, iron, and boron levels present in most waters studied were highest during the high water period, suggesting significant concentrations of these in the suspended sediments. Most Park surface waters were found to be of natural bacteriological quality; however, several locations of high total coliforms were noted. (Zielinski-IPA)
W81-01213

A SIMPLE METHOD USING A DISPOSABLE SYRINGE TO PREPARE SAMPLES FOR DELTA 018 MEASUREMENTS IN WATER SAMPLES,
Centro de Energia Nuclear na Agricultura, Sao Paulo (Brazil).
E. Matsui.
Analytica Chimica Acta, Vol 120, p 423-425, November, 1980.

Descriptors: *Oxygen isotopes, *Isotope studies, Syringes, Water analysis, Analytical techniques.

Commerical 10 ml disposable polypropylene syringes may be used for isotopic equilibration in delta 018 determinations in water samples. The procedure involves adding concentrated H2SO4 without contaminating the upper internal surface of the syringe, placing the piston in the cylinder without touching the acid, and pulling the sample of water into the cylinder. After the sample is shaken, the water volume is adjusted to 3.0 ml, CO2 is inserted to 10 ml, and the syringes placed in a heated water bath overnight. One technician can prepare 50 samples in 2 hours. (Cassar-FRC)
W81-01241

DETERMINATION OF TRACE AMOUNTS OF ALKYLBENZENE-SULFONATES BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY WITH FLUORIMETRIC DETECTION,
Kao Soap Co. Ltd. Tochigi (Japan).
A. Nakae, K. Tsuji, and M. Yamanaka.
Analytical Chemistry, Vol 52, No 14, p 2275-2277, December, 1980. 2 Fig, 4 Tab, 14 Ref.

Descriptors: *Alkylbenzene sulfonates, *Analytical techniques, Pollutant identification, Detergents, Gas chromatography, Water analysis.

Modifications in the high performance liquid chromatography method of determining trace amounts of alkylbenzene sulfonates in water produced improved analytical results. No preconcentration or derivatization was necessary. Use of 0.1 M sodium perchlorate in methanol/water (8:2) optimized operating conditions of the fluorimeter used to detect the components. Alkylbenzene sulfonates were well resolved according to alkyl chain lengths. Partial phenyl isomer compositions were also obtained. River water analysis by this modified method was reproducible within 2% relative standard deviation in the range of 0.097 micrograms per ml. (Cassar-FRC)
W81-01242

POLY(ACRYLAMIDOXIME) RESIN FOR DETERMINATION OF TRACE METALS IN NATURAL WATERS,
Massachusetts Univ., Amherst. Dept. of Chemistry.
M. B. Colella, S. Siggia, and R. M. Barnes.
Analytical Chemistry, Vol 52, No 14, p 2347-2350, December, 1980. 4 Tab, 30 Ref.

Descriptors: *Resins, *Analytical techniques, *Metals, Pollutant identification, Poly(acrylamidoxime), *Trace elements, Sea water, Ponds, Spectrometry.

Trace metal determinations in natural waters are important in pollutant identification and in cases of micronutrient depletion. Application of a poly(acrylamidoxime) resin to the determination of Fe(3+), Mn(2+), Cu(2+), Zn(2+), Co(2+), Ni(2+), Hg(2+), Pb(2+), Cd(2+), and Ag(1+) in sea water and pond water showed good agreement with values determined by differential pulse polarography or differential pulse anodic stripping voltammetry. Metals were removed from the resin by equilibrating with a 1:1 nitric acid/water mixture, a 1:1 HCl/water mixture, or a 1M thiosulfate solution. Concentrations of metals in the eluate were determined by atomic absorption spectrometry. This resin has several advantages over previously used materials. The alkali and alkaline earth metals in sea water do not interfere with analysis. Simple elution removes sequestered metals, allowing regeneration of the resin for subsequent analysis. (Cassar-FRC)
W81-01243

IDENTIFICATION OF CHLORINATED METHOXYBIPHENYLS AS CONTAMINANTS IN FISH AND AS POTENTIAL INTERFERENCES IN THE DETERMINATION OF CHLORINATED DIBENZO-P-DIOXINS,
Food and Drug Administration, Washington, DC. Div. of Chemical Technology.
D. W. Phillipson, and B. J. Puma.
Analytical Chemistry, Vol 52, No 14, p 2328-2332, December, 1980. 6 Fig, 1 Tab, 21 Ref.

Descriptors: *Polychlorinated biphenyls, *Pollutant identification, *Analytical techniques, Chlorinated hydrocarbon pesticides, Mass spectroscopy, Gas chromatography, Chemical analysis, Organic compounds, Dioxins, Fish.

Chlorinated methoxybiphenyls interfered with determination of polychlorinated dibenzo-p-dioxins in fish samples examined by gas-liquid chromatography/mass spectroscopy. Synthesized 3,3',4',5-tetrachloro-4-methoxy biphenyl and 2,3',4,4'-tetrachloro-3-methoxybiphenyl behaved similarly to the dioxins in cleanup procedures and in gas-liquid chromatography/mass spectroscopy properties. It is suggested that previous analytical results obtained on environmental samples be reexamined by selected ion monitoring exclusively for the isotopic molecular ions from dioxins. For reliable identification and quantification of polychlorinated dibenzodioxins, it might be necessary to examine the mass spectra to rule out the presence of polychlorinated methoxy biphenyls (by the absence of fragment ion clusters resulting from losses of CH3, CH3CO, and CH3CO + 2Cl from the M+ cluster). (Cassar-FRC)
W81-01245

MASS SPECTROMETRIC DETERMINATION OF DEUTERIUM IN WATER AT NATURAL LEVELS,
Australian Atomic Energy Commission Research Establishment, Lucas Heights.
P. E. Hartley.
Analytical Chemistry, Vol 52, No 13, p 2232-2234, November, 1980. 2 Fig, 2 Tab, 6 Ref.

Descriptors: *Mass spectromety, *Deuterium, *Water analysis, Isotope studies, Hydrologic data, Performance, Chemical analysis, Australia.

A new system for measuring the D/H ratio of natural water samples for hydrological investigations is described, and sample measurement data are provided. The system is based on an AEI MS20, a small 180 deg deflection machine. Improvements in furnace design and a memory correction technique have eliminated the necessity to introduce samples more than once except after large changes in D/H between samples. One hundred samples can be measured to an accuracy of 0.1% with 95% confidence in an 8-hour day. The system is being used in various hydrological investigations by the Australian Atmic Energy Commission Nuclear Hydrology Group. (Small-FRC)
W81-01246

PROFICIENCY TEST SAMPLE MEDIA FOR SINGLE AND MIXED PURE CULTURES OF WATER POLLUTION INDICATOR BACTERIA,
New York State Dept. of Health, Albany.
R. W. Toombs, and D. A. Connor.
Applied and Environmental Microbiology, Vol 40, No 5, p 883-887, Novermber, 1980.

Descriptors: *Water analysis, *Quality control, *Bioindicators, *Separation techniques, On-site tests, Analytical techniques, Pollutant identification, Coliforms, Cultures, Isolation, Enteric bacteria, Pseudomonas, Sampling, Storage, Potable water, Testing procedures, Water pollution.

Tests were conducted to find a suitable transport medium for culturing bacteria from water samples that would maintain Escherichia coli, Enterobacter cloacae and Pseudomonas aeruginosa in combination for 48 hours to provide a positive coliform count and a countable standard plate. Two media, designated NYSDH-1 and NYSDH-2, were formulated which required no special handling or reconstitution and maintained inoculated organisms with an 88% viability level for up to 48 hours. Sample preparation procedures and shipping and handling protocol were also devised for use with the new media. The stability of E. coli and P. aeruginosa in NYSDH-1 media and E. cloacae in NYSDH-2 media were investigated in pilot studies designed to simulate field conditions for analysis of potable water for coliforms by membrane filter and standard plate count and most probable number dilution tests. Actual field tests were conducted on a reference set of samples which was shipped to and analyzed by laboratories at the Environmental Protection Agency or in New York State. Statistical analyses of results showed that the media are satisfactory for use in laboratory quality control programs. (Geiger-FRC)
W81-01249

ORGANOCHLORINE COMPOUNDS IN AQUATIC ENVIRONMENTS,
Labor Inspection Directorate, Oslo (Norway).
J. E. Bjerk, and E. M. Brevik.
Archives of Environmental Contamination and Toxicology, Vol 9, No 6, p 743-750, 1980. 2 Tab, 10 Ref.

Descriptors: *Aquatic life, *Chlorinated hydrocarbon pesticides, Pentachlorobenzene, Octachlorostyrene, Hexachlorobenzene, Pesticide residues, Agricultural chemicals, Invertebrates, Fish, Polychlorinated biphenyls, Pollutants, Sediments, Path of pollutants, Absorption, *Norway, *Oslo Fjord area(Norway).

Body burdens of five organochlorine compounds were examined at two locations in the Oslo Fjord area of Norway in the following species: barnacles, bristle worm, brittle star, cod, common goby, crab, flounder, hermit crab, mussel, saithe, sea star, shrimp, and snail. Uniform levels of contamination were found for DDE, PCBs, and pentachlorobenzene, especially when data were compared on a fat weight basis. Hexachlorobenzene and octachlorostyrene were found at various levels of concentration in the different species. The ratio of PCB/DDE was constant at 10 among the invertebrates, and close to 15 for fish species. PCB levels ranged from 1.5 times the dry sediment level in mussel to 8.5 for flounder, giving an interspecific variation factor of 5.4. The corresponding factor for DDE was 4.6. Sedimentary contamination was minimal for HCB and DDE. The findings concerning DDE, PCBs and pentachlorobenzene suggest that direct uptake from water via respiratory organs occurs as a result of direct body contact with the contaminants, and makes this the major route of entry. Variable levels of HCB and octachlorostyrene are not explained by this theory. High residue levels in some species seem to result from feeding habits, even though it has been definitely demonstrated that accumulation through food chains occurs. (Baker-FRC)
W81-01250

SIMPLIFIED MONITORING PROCEDURE FOR BENZO(A)PYRENE, HEXACHLOROBENZENE AND PENTACHLOROPHENOL IN WATER,
Texas A and M Univ., College Station. Dept. of Chemistry.
C. S. Giam, D. A. Trujillo, S. Kira, and Y. Hrung.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 5, p 824-827, November, 1980. 2 Tab, 4 Ref.

Descriptors: *Analytical techniques, *Pollutant identification, *Organic chemicals, Water analysis, Chromatography, Insecticides, Fungicides, Herbicides, Pentachlorophenol, Hexachlorobenzene, Benzo(a)pyrene, Polycyclic hydrocarbons, Carcinogens, Agricultural chemicals.

Simplified methods of water analysis are reported which require only a 5.0 ml sample to measure concentrations of pollutants ranging from 0.2 to 220 ppb. The methods are useful for analysis of benzo(a)pyrene (BaP), hexachlorobenzene (HCB) and pentachlorophenol (PCP) as well as similar contaminants in water. For analysis of BaP, samples were twice extracted with petroleum ether and the extracts combined. Solvent was next evaporated with a slow stream of dry nitrogen filtered through a molecular sieve. The residue was dissolved in MeOH, and 50-100 upsilon l were analyzed by high pressure liquid chromatography (HPLC). BaP concentrations of 0.04 to 2.0 ppb were recovered with 80% or better accuracy. Samples containing HCB were extracted once with isooctane and the extract directly analyzed by gas chromatography with an electron capture detector. HCB concentrations of 0.5 ppb gave recoveries greater than 75%. Samples containing PCP were acidified with sulfuric acid and then extracted twice with petroleum ether/diethyl ether. Solvent was evaporated from the combined extracts by dry nitrogen as above. Residue was dissolved in acrylonitrile and analyzed by HPLC. PCP concentrations ranging from 80 to 200 ppb gave greater than 80% recoveries. (Baker-FRC)
W81-01251

FIELD AND LABORATORY METHODS FOR INVESTIGATING A MARINE GASOLINE SPILL,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
C. W. Dimock, J. L. Lake, C. B. Norwood, R. D. Bowen, and E. J. Hoffman.
Environmental Science and Technology, Vol 14, No 12, p 1472-1475, December, 1980. 2 Fig, 1 Tab, 20 Ref.

Descriptors: *Pollutant identification, *Gasoline, Chromatography, Mass spectrometry, Analytical techniques, Water pollution, Organic compounds.

A method for examining somewhat volatile hydrocarbon pollutants in water samples is described, which uses on-board liquid-liquid extraction followed by transfer of extracts to the laboratory and analysis by gas chromatography and gas chromatography-mass spectrometry. The method was used to measure gasoline compounds in seawater samples collected during the response to a spill situation. Samples were collected both of water and of bivalve mollusks near Block Island Sound, Rhode Island. The results of the analysis indicated that almost all of the gasoline compounds present in the water samples could be detected by this method. A portion of each of these individual compounds was, however, lost during sample handling and analysis. Recovery of gasoline compounds in spiked seawater samples was consistent and ranged from 50 to 70%. Gas chromatograms of extracts from most of the shellfish tissues showed some resemblance to those obtained from gasoline standards, but interfering peaks were also prominent. The analytical methodology used here could be successfully applied to a spill situation where no observable gasoline slick was present. If a slick were present the sampling bottle would probably be contaminated and the analysis biased. (Baker-FRC)
W81-01260

ANALYTICAL ISSUES IN COMPLIANCE MONITORING,
For primary bibliographic entry see Field 7A.
W81-01261

APPLICATIONS OF LANDSAT DATA FOR ESTIMATING PHYTOPLANKTON PRODUCTION IN LAKE CHAD (AFRICA). (APPLICATION DES DONNEES LANDSAT A L'ESTIMATION DE LA PRODUCTION DU PHYTOPLANCTON DANS LE LAC TCHAD),
Institut National de la Recherche Agronomique, Thonon-les-Bains (France).
For primary bibliographic entry see Field 2H.
W81-01262

ISOLATION OF 01 SERVOVARS OF VIBRIO CHOLERAE FROM WATER BY SEROLOGICALLY SPECIFIC METHOD,
Louisiana State Univ., Baton Rouge. Dept. of Microbiology.
K. W. Hranitzky, A. D. Larson, D. W. Ragsdale, and R. J. Siebeling.
Science, Vol 210, No 4473, p 1025-1026, November, 1980. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Separation techniques, *Pathogenic bacteria, *Louisiana, Water pollution, Public health, Human diseases, Water pollution effects, Aquatic bacteria, Adsorption, Water analysis, Laboratory tests, Pollutant identification, Assays, Path of pollutants, Bayous, Cholera.

Eleven cases of cholera occurred among Louisiana residents in 1978 and were traced to contaminated food containing the Vibrio cholerae bacteria of the serological variety 01. Cholera is generally transmitted by food, water or fomites polluted with human feces containing the bacteria. It became important to discern whether the 01 serovar responsible for the Louisiana cholera cases was imported from an endemic area by an infected person, or whether the bacterium was present in Louisiana as part of the normal aquatic flora. A method which combines the principles of serologically specific electron microscopy and enzyme-linked immunosorbent assay was used to isolate 01 serovars of V. cholerae from environmental water samples. The water was mixed with Tween 20 and passed through packed columns of polystyrene beads. The beads, which were coated with antibodies against the 01 antigenic determinants, were then washed with buffer and Tween 20, transferred to alkaline peptone broth, and incubated. Growth on the broth was transferred to selective medium on petri plates, and V. cholerae colonies were isolated and identified by routine microbiological procedures. Water samples taken from a south central Louisiana bayou showed the presence of 01 serovars of V. cholerae by this isolation technique. The method is also recommended for isolating Salmonella, Shigella and Legionella from water or other potentially pathological specimens. (Geiger-FRC)
W81-01282

A NOTE ON THE SENSITIVITY OF CHLORINE-STRESSED BIFIDOBACTERIA TO NALIDIXIC ACID,
Department of Water Affairs, Pretoria (South Africa). Hydrological Research Inst.
D. P. Sartory.
Journal of Applied Bacteriology, Vol 49, No 2, p 291-293, October, 1980. 1 Tab, 8 Ref.

Descriptors: *Bacteria, *Sewage effluents, Bifidobacteria, Nalidixic acid, Chlorine, Pollutant identification, Bioindicators, *Chlorination, Evaluation.

Bifidobacterium adolescentis, an indicator of fecal pollution, was proved sensitive to 10 micrograms per ml nalidixic acid after exposure to chlorinated sewage effluent containing 0.08 mg per 1,000 ml residual chlorine. Effluent containing 0.7 mg per 1,000 ml chlorine caused sensitivity at the level of 5 micrograms per ml of nalidixic acid. Normally, B. adolescentis is resistant to 200 micrograms per ml nalidixic acid. It was concluded that the Evison-Morgan medium (5 micrograms nalidixic acid per ml) would give a valid bacteria count from effluent containing less than 0.1 mg per 1,000 ml residual chlorine. The Resnick-Levin YN-6 media (80 micrograms nalidixic acid per ml) may give zero or a very low count of bacteria in chlorinated effluent. (Cassar-FRC)
W81-01290

IDENTIFICATION OF HAZARDOUS ORGANIC CHEMICALS IN FISH FROM THE ASHTABULA RIVER, OHIO, AND WABASH RIVER, INDIANA,
Environmental Research Lab., Duluth, MN.
D. W. Kuehl, E. N. Leonard, K. J. Welch, and G. D. Veith.
Journal of the Association of Official Analytical Chemists, Vol 63, No 6, p 1238-1244, 1980. 3 Fig, 3 Tab, 10 Ref.

Descriptors: *Pesticide residues, *Fish, *Pollutants, Water pollution, *Pollutant identification, Ashtabula River(OH), Wabash River(IN), DDT, Polychlorinated biphenyls, Endrin, Heptachlor, Arochlors, Organic compounds.

Composite fish samples from the Wabash River, Indiana, and the Ashtabula River, Ohio, were analyzed for pesticide residues by gas chromatography/mass spectroscopy using both electron impact and negative chemical ionization modes. The Wabash River fish sample contained 310 ppb DDT, 3210 ppb total polychlorinated biphenyls, 30 ppb hexachlorobenzene, 8.54 ppb trans-chlordane, 12.98 ppb cis-chlordane, 20.04 ppb trans-nonachlor, 4.89 ppb cis-nonachlor, and less than 0.50 ppb heptachlor, heptachlor epoxide, oxychlordane, and octachlorostyrene. Endrin, some of its manufacturing intermediates, and some metabolites were also found. Pentachlorophenol, a wood preservative, and pentachlorobenzyl alcohol were present. The Ashtabula River sample contained 130 ppb DDT, 7200 ppb PCB's, 3140 ppb hexachlorobenzene (the second highest level observed in previous work), 500 ppb octachlorostyrene, and less than 0.50 ppb of the chlordanes, nonachlors, and heptachlors. This sample also contained a number of polychlorinated hydrocarbons with 2-6 carbons. (Cassar-FRC)
W81-01292

GAS CHROMATOGRAPHIC DETERMINATION OF FLURIDONE AQUATIC HERBICIDE AND ITS MAJOR METABOLITE IN FISH,
Lilly Research Labs., Greenfield, IN. Agricultural Analytical Chemistry.
S. D. West, and R. O. Burger.
Journal of the Association of Official Analytical Chemists, Vol 63, No 6, p 1304-1309, November, 1980. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Pesticide residues, *Pollutant identification, *Fluridone, Herbicides, Gas chromatography, Analytical techniques, Fish.

The herbicide, fluridone (1-methyl-3-phenyl-5-(3-(trifluoro-methyl)phenyl)-4(1H)-pyridinone) and its major metabolite (1-methyl-3-(4-hydroxyphenyl)-5-(3-(trifluoromethyl)phenyl)-4(1H)-pyridinone) were determined in fish. The lower detection limit was 0.01 ppm, and recoveries averaged 84 + or - 14.7% for fluridone and 83 + or - 13.4% for the metabolite. Finely ground fish tissue was extracted with methanol, and the extract hydrolyzed with HCl to release the conjugated residues. After liquid-liquid partition purification with hexane and ethyl acetate, the sample was reacted with methyl iodide and brominated with phosphorus tribromide. Following Florisil column separation, the derivatives were quantified by electron capture gas liquid chromatography. (Cassar-FRC)
W81-01293

THE CHROMATOGRAPHIC AND GC/MS ANALYSIS OF ORGANIC PRIORITY POLLUTANTS IN WATER,
Finnigan Inst., Cincinnati, OH.
Q. V. Thomas, J. R. Stork, and S. L. Lammert.
Journal of Chromatographic Science, Vol 18, No 11, p 583-593, November, 1980. 5 Fig, 4 Tab, 6 Ref.

Descriptors: *Pollutant identification, *Gas chromatography, *Organic compounds, Water pollution, Analytical techniques, Legal aspects, Mass spectrometry, Separation techniques, Waste water, Sampling, Storage, Water analysis, Quality control, Data processing, Reviews, Water quality.

Of the US EPA's list of pollutants to be controlled under a 'Consent Decree' court ruling, 129 compounds and metals were designated as priority pollutants, based on their frequency of occurrence in point source industrial samplings. Methodology for the GC/MS analysis and chromatographic analysis for 114 of these priority pollutants in wastewater is reviewed, and sections on sampling, storage, equipment, sample preparation, and quality control are also included. Under the 'Best Available Technology' section of the Consent Decree a liquid-liquid concentration technique followed by GC/MS is recommended for TCDD (dioxin). Gas chromatographic methods using purge-and-trap concentration are applied to purgeable halocarbons and aromatics, plus acrolein and acrylonitrile. Phenols, phthalate esters, nitrosamines, pesticides, PCBs, nitroaromatics, polynuclear aromatic hydrocarbons (PAH), and haloethers are best analyzed by gas chromatography methods using liquid/liquid extraction. Liquid chromatography with liquid/liquid extraction is utilized for benzidine and its derivatives and PAHs. GC/MS methodology is also used in conjunction with liquid/liquid extraction at very acidic or basic pH levels for a number of phenolic compounds and pesticides and with purge trap concentration techniques for many of the purgeable organics. The legal aspects of the proposed analysis methods for the priority pollutants in relation to the National Pollutant Discharge Elimination System permits are also mentioned. (Geiger-FRC)
W81-01294

ISOLATION AND ENUMERATION OF FAECAL STREPTOCOCCI FROM NILE WATER (1975-1976),
Ministry of Agriculture and Water, Riyadh (Saudi Arabia).
F. A. Saleh.
Water Research, Vol 14, No 12, p 1669-1678, December, 1980. 6 Fig, 5 Tab, 38 Ref.

Descriptors: *Streptococcus, *Nile river, *Bioindicators, Separation techniques, Coliforms, Water pollution, Water pollution sources, Water analysis, Water quality, Farm wastes, Isolation, Rivers, Dams, Impoundments.

The value of the fecal streptococcus group as an indicator of water pollution was examined in 94 Nile River water samples taken from 3 segments of the river over a period of 16 months. Recovery of streptococci was performed by a modified thallous-azide technique and the standard M-enterococcus medium with a membrane filter method. Most probable number for fecal streptococcus was recorded with the aid of azide dextrose and ethyl violet azide (AD-EVA). The sources of fecal streptococci isolates were traced by four differential tests. The highest fecal streptococci readings of 100-1000/ml were recorded from water samples of the Cairo segment. Upon biochemical examination, about 78% of the strains recovered were assigned to atypical or unclassifiable categories. The remaining 22% were classified as S. faecalis and two of its variants, S. zymogenes and S. liquefaciens. All water samples tested were positive for the presence of streptococci. Results of TTC reduction and tellurite resistance tests suggested that the streptococci recovered were mostly of animal fecal origin. (Geiger-FRC)
W81-01340

CONTINUOUS MONITORING FOR SEWAGE-TREATMENT PURPOSES,
Severn-Trent Water Authority, Birmingham (England). Tame Div.
A. E. Hey.
Water Pollution Control, Vol 79, No 4, p 477-484, November, 1980.

Descriptors: *Monitoring, Analytical techniques, *Sewage treatment, *Activated sludge, Data transmission, Waste water treatment, Computers, Instrumentation, Suspended solids, Hydrogen ion concentration, Ammonia.

The continuous monitoring system for both biological filter and activated sludge plant effluents at the Minworth sewage treatment works is described. The station, located 60 meters from the activated sludge effluent discharge channel, contains a pumping system for automatic sampling, a system for distributing the samples to monitors, and a programmable electronic sequence timer for controlling sampling and valve-changing sequences. The monitoring system determines suspended solids by optical measurements, ammonia by gas sensing selective ion electrode, pH by electrode, and temperature by platinum resistance thermometer. Raw data is transmitted and updated at the receiving station every 2 minutes. Development work on extending the monitoring process to additional phases of the sewage treatment process is planned. (Cassar-FRC)
W81-01345

ISOLATION AND CHARACTERIZATION OF POLYMERIC ORGANIC MATERIALS IN A POLLUTED RIVER WATER,
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
R. Ishiwatari, H. Hamana, and T. Machihara.
Water Research, Vol 14, No 9, p 1257-1262, September, 1980. 4 Fig, 5 Tab, 9 Ref.

Descriptors: *Water pollution, *Rivers, Analytical techniques, Polymers, Resins, Organic compounds, Mass spectrometry, Oxidation, Separation techniques, Gas chromatography, Water analysis, *Tamagawa River(Japan), Japan, Water analysis, *Separation techniques, *Organic matter.

Amberlite XAD-2 resin was used to isolate organic matter from water samples taken from the Tamagawa River in Japan. With this technique, 40% of the total dissolved organic matter was isolated. The elemental compositions of the isolated organic materials from various locations were similar, amounting to carbon 41-48%, hydrogen 5.8-7.0% and nitrogen 4.7-6.7%. Other tests performed on the isolated material included molecular weight distribution, u.v. and i.r. spectra, and GC/MS analysis of alkaline potassium permanganate oxidation products. More than 50% of the isolated organic matter had molecular weights higher than 5000. Alkaline permanganate oxidation of the isolated organic materials produced aliphatic monocarboxylic acids, dicarboxylic acids and benzene-mono, di tri and tetracarboxylic acids. The relative amounts of these three groups can apparently be explained in terms of the nature and degree of pollution. (McKeon-FRC)
W81-01346

COLIPHAGES AS INDICATORS IN A TREATMENT PLANT,
Istituto Superiore di Sanita, Rome (Italy).
G. Ignazzitto, L. Volterra, F. A. Aulicino, and A. M. D'Angelo.
Water, Air, and Soil Pollution, Vol 13, No 4, p 391-398, December, 1980. 13 Tab, 6 Ref.

Descriptors: *Waste water treatment, *Bioindicators, *Coliforms, E. coli, Pollutant identification, Water pollution, Activated sludge, Analytical techniques.

Use of coliphages as indicators of water pollution was investigated in raw sewage influent, primary sedimentation tank effluent, and activated sludge effluent. Although fecal coliforms and coliphages showed a general reduction through the treatment process, the two populations were not always closely related. Water samples stored for 2 weeks showed a decay in plaque forming units. Several strains of E. coli were tested. Phage No. 8113 appeared to be the best marker. (Cassar-FRC)
W81-01352

DETERMINATION OF METALS IN SEWAGE EFFLUENTS,
T. B. Webster.
Water Pollution Control, Vol 79, No 4, p 511-514, November, 1980. 3 Tab, 27 Ref.

Descriptors: *Analytical techniques, *Sewage effluents, *Metals, *Pollutant identification, Spectrophotometry, Zinc, Copper, Iron, Lead, Nickel, Cadmium, Trace elements.

An improved method for analyzing metals at the microgram per liter level in sewage effluents is described. The sample undergoes nitric acid digestion to remove emulsion-producing substances. After neutralization and chelation, the sample is extracted with methyl isobutyl ketone. Analyses for zinc, copper, iron, lead, nickel, and cadmium are carried out using a Pye-Unicam SP90 Series 2 atomic absorption spectrophotometer coupled with a 10mV recorder. Reagent blanks should be run at

the same time and corrections made to compensate for trace metals in the nitric acid and other reagents. By increasing the sample to solvent ratio, lower limits of detection are possible. (Cassar-FRC)
W81-01356

BACTERIOLOGICAL MONITORING OF POLLUTION IN SHELLFISH: METHODOLOGICAL EVALUATION,
Instituto Superiore di Sanita, Rome (Italy). Lab. di Igiene del Territorio.
L. Volterra, F. A. Aulicino, E. Tosti, and M. Zicarelli.
Water, Air, and Soil Pollution, Vol 13, No 4, p 399-410, December, 1980. 1 Fig, 6 Tab, 9 Ref.

Descriptors: *Pollutant identification, *Coliforms, *Shellfish, Analytical techniques, Water pollution, Bacteria, Mussels, Gulf of Pozzuoli, *Naples(Italy), *Italy.

Three different methods of determining fecal pollution in shellfish were compared. The first method, proposed by the Italian Government, uses flesh and intervalve water obtained from groups of 10 shellfish each, diluted with saline solution, to analyze for total and fecal coliforms by the most probable number technique. Method 2, proposed by the British Ministry of Agriculture, Fisheries, and Food, uses the flesh only of 20 shellfish diluted with 0.1% peptone water to analyze for bacteria by the pour plate method. The third method, WHO/UNEP, uses 25 grams of shellfish flesh without intervalve water, diluted with 1% peptone water and analyzed by the most probable number technique. Inclusion of intervalve water in the sample introduces a variability factor, decreasing or increasing the bacterial counts depending on quality of the growing water. In general, the most probable number of techniques give higher values than the pour plate (direct count) method. Sample size does not affect results. Simultaneous analyses on flesh, intervalve water, and growing water show great variations in bacterial contamination. (Cassar-FRC)
W81-01371

5B. Sources Of Pollution

CHARACTERIZATION OF STORM RUNOFF IN LAS VEGAS VALLEY, NEVADA,
Nevada Univ. System, Reno. Water Resources Center.
For primary bibliographic entry see Field 4C.
W81-01205

OPPORTUNITIES FOR U.S. FISH AND WILDLIFE SERVICE INITIATIVES RELATED TO URANIUM MINING AND MILLING IN THE WESTERN UNITED STATES,
Enviro Control, Inc., Fort Collins, CO.
G. C. Horak, and J. E. Olson.
In: Proceedings of the Uranium Mining and Milling Workshop, May 28-29, 1980, Fort Collins, Colorado, Fish and Wildlife Service Report FWS/OBS-80/57, August, 1980, p 14-61. 2 Fig, 12 Tab, 60 Ref.

Descriptors: *Uranium mining, *Wildlife, *Mine wastes, *Radioactive wastes, Wildlife habitats, Water pollution, Mills, Mineral industry, *Environmental effects, Trace elements, Radioactive waste disposal, Air pollution.

In the western United States, uranium mining and milling have disturbed 14,900 hectares. Because annual uranium production is predicted to increase nearly seven-fold by the year 2000, mining and milling are expected to impact an additional 57,200 hectares. Exploration will temporarily impact an additional 724,500 hectares. Potential impacts of conventional uranium mining include habitat destruction, air pollution, water pollution, radiation exposure, and trace element toxicity. Unconventional mining may cause less surface disturbance, and the site may be easier to reclaim. The principle impact to fish and wildlife resulting from milling activities, exclusive of tailings disposal, is surface habitat destruction. Mill tailings ponds and piles represent a source of direct injury or contamination of wildlife, radon emanations, pond seepage, and spills of tailings through dike breaches. Mill decommissioning and mine reclamation may not have a major impact on fish and wildlife, but inactive tailing sites present a hazard until they are decontaminated. The Fish and Wildlife Service is now involved in the early planning of uranium projects, standards settings, and research and development program planning to reduce the impacts of uranium mining and milling. (Moore-SRC)
W81-01216

SANDIA'S ACTIVITIES IN URANIUM MILL TAILINGS REMEDIAL ACTION,
Sandia National Labs., Albuquerque, NM.
S. Neuhauser.
In: Proceedings of the Uranium Mining and Milling Workshop, May 28-29, 1980, Fort Collins, Colorado, Fish and Wildlife Service Report FWS/OBS-80/57, August, 1980, p 68-73. 1 Tab, 1 Ref.

Descriptors: *Uranium mill tailings, *Radioactive waste disposal, *Environmental effects, Wildlife habitats, Soil contamination, Water pollution, Hydrology, Land use, *Pollution abatement.

The Uranium Mill Tailings Radiation Control Act of 1978 requires that remedial action be taken at over 20 inactive uranium mill tailings sites. The proposed standards promulgated under this Act by the Environmental Protection Agency require cleanup of soil and contaminated structures at existing locations. In several cases the present sites are felt to be too close to human habitations or to be otherwise unacceptably located, and these tailings will probably be relocated. The candidate alternative sites must satisfy certain geophysical, hydrological, and meteorological criteria. Environmental impact studies at these sites must consider not only the direct impacts of relocation efforts at present and proposed sites, but also land-use policies, socio-economic factors, the impacts of borrow pit and roadway construction, and other factors. A vital part of these studies, of course, is consideration of potential effects on fish and wildlife and mitigating actions to restore or improve unavoidably affected habitats. The possibility of contamination of wildlife at tailings sites both before and after stabilization requires further study. (Moore-SRC)
W81-01217

EPA ACTIVITIES FOR THE CONTROL OF URANIUM MINING AND MILLING EFFLUENTS,
Environmental Protection Agency, Denver, CO.
P. Wagner.
In: Proceedings of the Uranium Mining and Milling Workshop, May 28-29, 1980, Fort Collins, Colorado, Fish and Wildlife Service Report FWS/OBS-80/57, August, 1980, p 77-87. 1 Fig, 2 Tab.

Descriptors: *Uranium mining, *Radioactive wastes, *Water pollution sources, Radioactive waste disposal, Wildlife, Soil contamination, Environmental effects, Mine wastes, Mills, Groundwater, Regulation, Inter-agency cooperation, Pollution abatement.

Uranium mining and milling operations can result in the contamination of the environment with technologically enhanced natural radioactivity. The primary pathways by which radioactivity reaches a dose receptor are: direct external gamma exposure from airborne or groundwater deposited radionuclides; inhalation of radioactive materials; ingestion of radionuclides through contaminated foodstuffs; and ingestion of contaminated water. Congress has provided the Environmental Protection Agency (EPA), Nuclear Regulatory Commission (NRC), and Department of Energy (DOE) with a patchwork of Acts directed at specific processes associated with uranium mining and milling. In many cases, EPA has been ordered to set standards in consultation with NRC and DOE, and the latter two agencies are to implement them. Existing, proposed, or planned regulations will protect the environment from all effluents except groundwater contamination from milling activities. In addition to developing regulations for the uranium fuel cycle, EPA aids NRC Agreement states in their review of impact reports submitted by applicants for milling licenses. NRC solicits EPA review of environmental impact statements that NRC develops for milling projects under its jurisdiction. Future cooperation with the Fish and Wildlife Service may aid EPA efforts to control mining and milling effluents. (Moore-SRC)
W81-01218

DETERMINATION OF ATMOSPHERIC PHOSPHORUS ADDITION TO LAKE MICHIGAN,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
S. J. Eisenreich, P. J. Emmling, and A. M. Beeton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-219124, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-063, July, 1980. 60 p, 11 Fig, 10 Tab, 36 Ref, 1 Append. R 803238.

Descriptors: *Lake Michigan, *Phosphorus, Chemistry of precipitation, *Water pollution sources, Great Lakes, Eutrophication, Nutrients, Precipitation(Atmospheric), Air pollution, Seasonal, Aeolian soils, Path of pollutants, Air entrainment, Lake basins.

Lake Michigan has a large surface area, but a small drainage basin suggesting that the atmosphere may be a significant source of natural and anthropogenic components representing a sizeable portion of the total nutrient budget. Bulk precipitation was collected on a monthly basis in the Lake Michigan basin for 18 months during 1975-1976 to determine atmospheric phosphorus loadings to Lake Michigan. The sampling network consisted of bulk collectors at 23 land stations and 2 in-lake buoys located off urban and rural areas. Annual phosphorus loading to Lake Michigan from atmospheric sources was 1,690,000 kg in 1976, which represents 15.7% of the total budget based on 1975 data. In 1976, atmospheric deposition of phosphorus in Lake Michigan was dominated by a dry fall component likely derived from wind-blown soil. Actual in-lake loading of phosphorus may exceed loading calculated from land-based stations by up to 50%. The phosphorus weighted average concentration in bulk precipitation was 0.050 and 0.064 mg/l in the north and south basins, respectively, as compared to the average lake water concentration of 0.01 mg/l. Seasonal variations in loading rates showed maxima in late spring and early summer, and minima in winter. Wet-only precipitation concentrations for phosphorus averaged 15% of bulk deposition values, and the pH averaged one unit lower than bulk deposition. (Moore-SRC)
W81-01236

ORGANOCHLORINE COMPOUNDS IN AQUATIC ENVIRONMENTS,
Labor Inspection Directorate, Oslo (Norway).
For primary bibliographic entry see Field 5A.
W81-01250

ACCUMULATION OF COPPER IN FLUVIAL SEDIMENTS AND YELLOW WATER LILLIES (NUPHAR LUTEA) AT VARYING DISTANCES FROM A METAL PROCESSING PLANT,
Turku Univ. (Finland). Dept. of Biology.
K. Aulio.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 5, p 713-717, November, 1980. 1 Fig, 1 Tab, 13 Ref.

Descriptors: *Copper, *Plant tissues, *Fluvial sediments, Sediments, Metals, Deposition, Plant physiology, Sediment load, Industrial wastes, Heavy metals, *Finland, *River Kokemaenjoki(Finland)

The accumulation of copper in fluvial sediments and in dominant aquatic vegetation in the vicinity of a point source of heavy metal pollution was investigated. Samples of sediment were collected from the River Kokemaenjoki in western Finland. The site under study is located near a base metal purification and processing plant in Pori, which

produces an annual amount of 40-50,000 tons of copper with a discharge of 24 kg/d of copper into the river. The levels of copper in the sediments near the plant indicate an enrichment of discharged metals. The highest concentration of total copper was 1020 ppm. Accumulation of metal took place only in a narrow shallow water zone 0-8 m from shoreline. Levels of copper in deep water sediments were from 17 to 54 ppm. Most of the copper load is carried downstream and enters the Baltic Sea. The copper accumulated in various plant organs of the Nuphar lutea showed increased levels when compared to plants away from the site. Highest recorded concentrations for leaves and petioles were 98 and 115 ppm, respectively. Concentrations in below-ground organs of the plant were low, indicating selectivity in uptake/exclusion and translocation in the plant. The condition of the plants indicated extreme tolerance to heavy metal contamination. (Baker-FRC)
W81-01252

DISTRIBUTION OF POLYCHLORINATED BIPHENYLS IN THE FORT EDWARD, NEW YORK, WATER SYSTEM,
Rensselaer Polytechnic Inst., Troy, NY.
M. Brinkman, K. Fogelman, J. Hoeflein, T. Lindh, and M. Pastel.
Environmental Management, Vol 4, No 6, p 511-520, November, 1980. 3 Fig, 4 Tab, 25 Ref.

Descriptors: *Polychlorinated biphenyls, *Water pollution sources, *Chemical wastes, Water quality, Fort Edward(NY), Aquatic life, Soil, Sediments, Reservoirs, Impoundments, Potable water, Industrial wastes, Pollutant identification, Organic compounds.

Concentrations of polychlorinated biphenyls (PCBs) were determined in water, soils, sediment, and aquatic life of the Fort Edward, New York, water system, an area less than 0.5 km from a PCB disposal site. Types of PCB identified in samples were Arochlor 1016 and 1254. Water from reservoirs and the distribution system had significant and uniform PCB levels (median 100 nanograms per liter). Seven samples of groundwater and streams feeding the reservoirs showed no detectable PCB. The Hudson River at Fort Edward contained 530 ng per liter 5 times the reservoir level. A 30-day composite rainfall sample showed high levels of Arochlor 1016 (1,300 ng per liter), suggesting that this may be the principal source of PCB contamination in the reservoir system. One of the 13 samples of reservoir sediment contained 190 ng per g; the remaining 12, 40 ng per g or less. Similarly, the 5 soil samples showed wide variation. One level was high, 160 ng per g; and the others, 30 ng per g or less. PCB was more concentrated in the biota than in water or sediment. Twenty of 32 samples of algae and animal life contained detectable PCB, with a prefernce for the more highly chlorinated form. The macroinvertebrates, sediment dwellers, showed high levels of 580 ng per g. Estimates of total PCB level in the drinking water were 104 ng per liter, less than the 160 ng per liter limit used by the New York State Health Department. Efforts to reduce this low level of PCB are best directed toward reducing input from the sources. (Cassar-FRC)
W81-01256

MODELLING GROUNDWATER CONTAMINATION FROM LAND-APPLIED SWINE WASTE,
British Columbia Univ., Vancouver. Dept. of Bio-Resource Engineering.
For primary bibliographic entry see Field 7B.
W81-01273

TRANSPORT OF TRACE ELEMENTS IN ECOSYSTEMS OF THE BARHALDE WATERSHED IN THE SOUTHERN BLACK FOREST,
Institut fuer Bodenkunde und Waldernahrungslehre, Freiburg im Breisgau (Germany, F.R.).
K. Stahr, H. W. Zottl, and FR. Hadrich.
Soil Science, Vol 130, No 4, p 217-224, October, 1980. 6 Fig, 3 Tab, 15 Ref.

Descriptors: *Trace elements, *Chemistry of precipitation, *Metals, Beryllium, Copper, Water analysis, Soil chemical properties, Rainfall, Runoff, Lead, Cadmium, Germany, *Black Forest(Federal Republic of Germany), Heavy metals, *Path of pollutants.

Concentrations of trace elements and macroelements in rainfall, canopy drip, runoff, and soil solution were determined in a very cool, humid section of the Balck Forest. Samples were collected at four free-drained and three hydromorphic sites, and the concentrations of 20 elements and the pH of the samples were determined. Beryllium had the lowest input and the highest output. It was primarily mobilized in the mineral topsoil, and only a small amount was reabsorbed by humic acids or top soil or taken up by plants. None was leached by leaves. Lead concentrations were highest in precipitation, but only about 5% of the input appeared in the output. Cadmium, copper, and lead were all absorbed by the humus and iron oxide accumulation horizons of podzols and Ockererde. Copper was absorbed in all soils except podzols, and cadmium was not absorbed in mineral soil. Recent increases in atmospheric output of these trace minerals probably resulted in the enrichment and rise of turnover. (Small-FRC)
W81-01278

ISOLATION AND CHARACTERIZATION OF BACTERIA FROM THE BALTIC SEA,
Swedish Water and Air Pollution Research Lab., Stockholm.
A. H. Neilson.
Journal of Applied Bacteriology, Vol 49, No 2, p 199-213, October, 1980. 2 Fig, 5 Tab, 70 Ref.

Descriptors: *Bacteria, *Baltic Sea, *Salt tolerance, Alteromonas putrefaciens, Pseudomonas, Aerobic bacteria, E. coli, Water pollution, Pollutants.

Samples of water and sediment from 3 localities in the Baltic Sea (a control site and two sites subjected to industrial discharge) were examined to determine bacterial populations. The areas subject to pollution showed the highest numbers of bacteria, which included Enterobacteriaceae, Pseudomonas, Aeromonas hydrophila, Alteromonas putrefaciens, and Gram positive bacteria. None of the isolates had an absolute requirement for NaCl. The majority of isolates were salt tolerant, though of fresh water origin, and able to grow aerobically at salinities comparable to sea water. However, the Enterobacteriaceae were not able to grow anaerobically under comparable conditions. Samples of E. coli, Klebsiella pneumoniae and Yersinia enterocolitica survived for three weeks at 17C in sea water lacking carbon and nitrogen nutrients. Therefore, the persistence of pathogens in saline water should be re-evaluated. (Cassar-FRC)
W81-01291

DISTRIBUTION OF OIL POLLUTION RESIDUES,
Sydney Univ. (Australia). Dept. of Chemical Engineering.
I. A. Furzer.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE6, p 1171-1189, December, 1980. 13 Fig, 2 Tab, 26 Ref.

Descriptors: *Mathematical models, *Oil pollution, *Estuaries, Rivers, Water pollution, Model studies, Path of pollutants, Sediments, Oxygenation, Water quality control, Tides, Sedimentation, Oil spills.

A new mathematical model was devised to simulate the distribution of residues from oil pollution along the length of a closed estuary. The proposed model is comprised of a dual system of continuously stirred tank reactors. Oil pollution residues which start out in suspension in the aqueous phase are transferred by settling to the sediments of the tanks. The settling rate of the residues constitutes an important parameter of the model, which can be evaluated by minimizing a least squares error objective function between the simulated and observed distribution of oil pollution residues along the system. A CYBER computer and an effective numerical technique were employed to solve the system of equations. Oil pollution residues were evaluated in the Parramatta and Duck Rivers of Australia using this model. Results showed that these rivers, conservatively estimated, contain 8,000 tons of oily residues. It was estimated that clean up of this particular pollution problem would take several decades. The new sediment model systems will be able to cover single and multipoint pollution sources and are recommended for use in the water quality management of closed estuaries. (Geiger-FRC)
W81-01295

WAIKATO RIVER POLLUTANT FLUSHING RATES,
Hamilton Science Center (New Zealand).
J. C. Rutherford, M. E. U. Taylor, and J. D. Davies.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE6, p 1131-1150, December, 1980. 10 Fig, 5 Tab, 13 Ref.

Descriptors: *Dyes, *Dispersion, *Environmental engineering, *Rivers, Dye concentrations, Potable water, Mathematical models, Tracers, Water supply, Pollution, Water quality, Advection, Longitudinal dispersion, Similarities, Waikato River, New Zealand, On-site investigations, *Path of pollutants.

A dye dispersion experiment was conducted in the Waikato River in New Zealand in order to appraise methods of protecting the supply of potable water. Results showed persistent lateral inhomogeneity of concentration even well below the advective zone. The Fickian model of longitudinal dispersion described the dye profiles near the peak, but predicted pollutant arrivals and departures prematurely. Tracer data exhibited characteristics of a self-similar process in which average concentrations at any point can be calculated from peak concentration, arrival time, and duration of concentrations above half the peak, using a single scaling curve. A hybrid technique was developed for routing pollutant slugs along a nonuniform channel. It makes use of the Fickian model, and it reconstructs the entire concentration profile with greater accuracy. (Titus-FRC)
W81-01299

BLOOM-FORMING CYANOBACTERIUM MICROCYSTIS AERUGINOSA OVERWINTERS ON SEDIMENT SURFACE,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
T. Preston, W. D. P. Stewart, and C. S. Reynolds.
Nature, Vol 288, No 5789, p 365-367, November 27, 1980. 2 Fig, 14 Ref.

Descriptors: *Path of pollutants, *Algae, *Water pollution sources, Cyanophyta, Microcystis aeruginosa, Odor-producing algae, Sediments, Epilimnion, Stratification, Water quality, Reservoirs, Lakes.

Experiments with N15 tracer incorporated into NaNO3 fertilizer showed that Microcystis aeruginosa, a bloom-forming blue-green alga, overwintered on the sediment surface in an experimental pond and provided an inoculum of colonies from which the following year's epilimnetic population developed. After addition of the labelled fertilizer to the water in August, 1976, an extensive Microcystis aeruginosa bloom developed in the epilimnion. In October the colonies migrated to the sediment surface, forming a clearly visible layer 1.0 cm thick. N15 was removed from the water by flushing in February, 1977. Particulate N15 in the water increased to a maximum in May, then declined in June with the onset of thermal stratification. In July and August the N15 concentration and Microcystis population were present in the surface waters. In late September M. aeruginosa and N15 particulates sedimented. (Cassar-FRC)
W81-01302

USE OF SELECTED FRESHWATER BIVALVES FOR MONITORING ORGANOCHLORINE PESTICIDE RESIDUES IN MAJOR MISSISSIPPI STREAM SYSTEMS, 1972-73,

Bureau of Marine Resources, Long Beach, MS.
R. L. Leard, B. J. Grantham, and G. F. Pessoney.
Pesticides Monitoring Journal, Vol 14, No 2, p 47-52, September, 1980. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Pesticide residues, *Water pollution sources, *Clams, Mississippi, DDE, DDT, Toxaphene, Methyl parathion, Chlordane, Halogenated pesticides, Agricultural runoff, Aquatic animals, Bioindicators.

Seven species of freshwater clams, collected in 13 streams representing 5 river basins throughout Mississippi, were analyzed for pesticide content. Highest levels of toxaphene and DDT were found in the streams located in agricultural regions. DDT and its metabolites showed a large reduction between 1972 and 1973, corresponding with decreased usage of DDT and with large-scale flooding in the state. Although no pesticide residues were found in 1972 water samples, toxaphene and methyl parathion were detected in water samples from some sites in 1973, reflecting an increase in use of these chemicals. However, toxaphene in clam samples decreased between 1972 and 1973. Chlordane was found in only 2 samples in 1972. Clams were shown to be effective monitors of pesticide content. C. manilensis was proved the best indicator of change, having higher and lower levels than the other species. Pesticide levels in water samples did not reflect concentrations in biota. (Cassar-FRC)
W81-01303

PESTICIDES IN GROUND WATER BENEATH IRRIGATED FARMLAND IN NEBRASKA, AUGUST 1978,
Nebraska Univ., Lincoln. Conservation and Survey Div.
R. F. Spalding, G. A. Junk, and J. J. Richard.
Pesticides Monitoring Journal, Vol 14, No 2, p 70-73, September, 1980. 1 Fig, 1 Tab, 17 Ref.

Descriptors: *Pesticide residues, *Water pollution, Pollutant identification, Potable water, Atrazine, Alachlor, Irrigation water, Herbicides, Nebraska, Nitrates, Chlorinated hydrocarbon, Pesticides.

Samples of water from 14 irrigation wells in the Central Platte region of Nebraska were analyzed for residues of 13 pesticides and nitrate-nitrogen. Atrazine, the most commonly used herbicide in this area, was found in all samples. Levels ranged from 0.06 to 3.12 micrograms per liter. Nitrate-nitrogen concentrations, which ranged from 17.1 to 34.3 mg per liter, correlated with atrazine levels with a coefficient of r = 0.55. Alachlor levels above 0.01 micrograms per liter appeared in 2 samples. It is believed that both atrazine and alachlor migrated vertically to the ground water. Levels of 2,4-D, EPTC, silvex, simazine, lindane, dieldrin, heptachlor, heptachlor epoxide, endrin, and methoxychlor were below detectable limits. DDT and DDE levels were less than 0.01 micrograms per liter. Although all reported levels were below limits for drinking water standards, the atrazine-nitrate combination is capable of forming nitrosamines. (Cassar-FRC)
W81-01304

MOVEMENT OF CHLORIDE IN A SOIL WITH VARIABLE CHARGE PROPERTIES: I. CHLORIDE SYSTEMS,
Sydney Univ. (Australia). Dept. of Soil Science.
For primary bibliographic entry see Field 5E.
W81-01323

MOVEMENT OF CHLORIDE IN A SOIL WITH VARIABLE CHARGE PROPERTIES: II. SANITARY LANDFILL LEACHATE,
Sydney Univ. (Australia). Dept. of Soil Science.
For primary bibliographic entry see Field 5E.
W81-01324

NOTE ON HEAVY METAL CONCENTRATION IN THE AQUATIC ENVIRONMENT OF THE KITAKYUSHU DISTRICT IN JAPAN, 1976-1977,
Kitakyushu Municipal Inst. of Environmental Health Sciences (Japan).
H. Sakino, A. Hashimoto, Y. Uchimura, S. Tateishi, and T. Akiyama.
Water Research, Vol 14, No 9, p 1233-1237, September, 1980. 2 Fig, 3 Tab, 3 Ref.

Descriptors: *Water pollution, *Heavy metals, *Rivers, *Industrial wastes, Cadmium, Copper, Lead, Estuaries, Sea water, Analytical techniques, Japan, Kitakyushu, Dokai Bay(Japan).

Heavy metals concentrations in the aquatic environment of the Kitakyushu district in Japan were investigated from 1976 to 1977. Cadmium, copper and lead samples were analyzed for all rivers which run through the area, the bay, and the sea surrounding the district. Results obtained were compared with values found in the literature for metals concentrations in other parts of the world. This comparison showed no significant pollution except for concentrations of lead in Dokai Bay, which averaged 40 micrograms per liter. The industrial activity surrounding the bay was responsible for the high concentrations of lead. (McKeon-FRC)
W81-01338

LINEAR ALKYLBENZENE SULFONATES IN RIVER, ESTUARY AND BAY WATER,
Tokyo Metropolitan Univ. (Japan), Dept. of Chemistry.
H. Hon-nami, and T. Hanya.
Water Research, Vol 14, No 9, p 1251-1256, September, 1980. 4 Fig, 3 Tab, 13 Ref.

Descriptors: *Rivers, *Estuaries, *Sea water, *Alkylbenzene sulfonates, Bays, Detergents, Foaming, Analytical techniques, Biodegradation, Statistical methods, Water pollution, Japan, Tama River(Japan), *Tokyo Bay.

Linear alkylbenzene sulfonates (LAS) in aquatic environments were determined by combined gas-liquid chromatography (GLC) and mass spectrometry (MS). LAS were determined as their methyl sulfonate derivatives by GLC-MS. The ratios of the concentrations of LAS to those of methylene blue active substances (MBAS) in river and bay water were estimated to be 0.40-0.85 and less than 0.20 respectively. The major components of LAS in the commercial detergent were the C(11) and the C(12) LAS. The LAS composition in the waters did not vary appreciably with season or with sampling location. In river and estuary water, compared to commercial detergent, the proportions of C(12) and C(13) LAS decreased, while those of C(10) and C(11) LAS increased. The 2-phenyl isomer decreased. These findings agree with predictions based on biodegradation rates of pure LAS in river water. The LAS composition in bay water did not follow these predictions; the proportions of C(10) and C(11) LAS slightly decreased while those of C(12) and C(13) LAS increased compared with the river and estuary waters. (McKeon-FRC)
W81-01348

POTENTIAL SIGNIFICANCE OF INSECTS IN THE REMOVAL OF CONTAMINANTS FROM AQUATIC SYSTEMS,
EG and G, Inc., Waltham, MA.
C. A. Menzie.
Water, Air, and Soil Pollution, Vol 13, No 4, p 473-479, December, 1980. 1 Fig, 2 Tab, 22 Ref.

Descriptors: *Insects, *Water pollution, Sediments, Chemical wastes, Aquatic insects, Aquatic soils, Wastes, Path of Pollutants, Mathematical models, Bioindicators, Water quality, Projections.

Insects which live in water and sediments during the larval stage may remove chemical contaminants from this system when they leave the aquatic environment as adults. The extent of contamination removal was estimated by a simple model using the following factors: concentration of chemical contaminant, time interval, production of larval biomass, bioconcentration factor, proportion of biomass removed by adult emergence, density of sediment, and depth of sediment. Three levels of insect production (100, 15, and 1 gram per square meter per year) and 3 bioconcentration factors (10,000, 1,000, and 100X) were considered. Using the highest production and bioconcentration figures, insects could remove 50% of contamination from a 30 cm thick sediment layer in 1.2 years. The lowest production and bioconcentration conditions would require 12,000 years for the same 30 cm sediment. Moderate production levels with bioconcentration factor of 10,000 would result in removal of 50% of the contamination in 8 years; a factor of 1,000, 80 years. (Cassar-FRC)
W81-01354

CASE STUDIES OF ACRYLAMIDE POLLUTION RESULTING FROM THE INDUSTRIAL USE OF POLYACRYLAMIDES,
Plymouth Polytechnic (England). Dept. of Environmental Science.
L. Brown, M. M. Rhead, and K. C. C. Bancroft.
Water Pollution Control, Vol 79, No 4, p 507-510, November, 1980. 2 Tab, 16 Ref.

Descriptors: *Acrylamide, *Polyacrylamides, *Industrial wastes, Water pollution sources, Pulp and paper industry, *Waste water treatment, Polymers, China industry, Pollutant identification, Potable water.

Acrylamide, which has a low recommended concentration (0.25 micrograms per liter) in potable waters, biodegrades slowly. Therefore, effluents from several industries using polyacrylamides were analyzed to determine acrylamide levels. Process waters and effluents from a china clay factory which recycles water showed no acrylamide (detection limit, 0.2 micrograms per liter). A laboratory-scale 100 fold overdose of polymer resulted in an acrylamide concentration of 11.2 micrograms per liter. No detectable acrylamide was found in effluents from a sewage works using polymers for sludge conditioning. A deliberate 100-fold overdose in a settlement tank showed a maximum of 0.7 micrograms per liter in stream water receiving the effluent. In tests at 3 paper mills, no detectable acrylamide was found in 2 mills. The third mill showed about 10 micrograms per liter in pulping recycle water. Final effluent contained less than 1 microgram per liter, and river water below effluent discharge, less than 0.2 micrograms per liter. It was determined that high acrylamide levels in recycle water were a result of the waste paper reclamation process. Chlorination of water smaples containing acrylamide (0 to 500 micrograms per liter) did not reduce acrylamide concentration. (Cassar-FRC)
W81-01355

UNUSUAL BEHAVIOUR OF CILIATED PROTOZOA IN A SECONDARY SETTLEMENT TANK,
Yorkshire Water Authority (England). Southwestern Div.
For primary bibliographic entry see Field 5D.
W81-01358

MOUNTAIN RESIDENTIAL DEVELOPMENT-MINIMUM WELL PROTECTIVE DISTANCES-WELL WATER QUALITY,
California State Univ., Northridge. Dept. of Health Science.
K. L. Ford, J. H. Schott, and T. J. Keefe.
Journal of Environmental Health, Vol 43, No 3, p 130-133, November/December, 1980. 1 Fig, 3 Tab, 9 Ref.

Descriptors: *Well spacing, *Water pollution control, *Water quality, Colorado, Domestic wastes, Waste water disposal, Wells, Septic tanks, Coliforms, Nitrates, Jefferson County(CO).

Well water samples were collected and wells were inspected in 164 sites within a 300 square mile area in a mountainous portion of Jefferson County, Colorado, an area which has experienced rapid population growth. Analysis for coliform bacteria and nitrate nitrogen revealed that coliform contamination was not related to lot size or distance from waste water effluent sources. However, there was a definite relationship between nitrate-nitrogen concentration and these factors. A statistical study

showed that wells with a protective distance of 100 feet had a 21.8% probability of contamination (greater than 10 mg per liter of nitrate-nitrogen); a 200 foot distance reduced the probability to 9.4%. Therefore, a 200 foot minimum distance from the nearest effluent source was recommended. This requires a lot size of about 2 acres. (Cassar-FRC)
W81-01363

THE EFFECT OF STORM INTERVAL ON THE TRANSPORT OF SOLUBLE PHOSPHORUS IN RUNOFF,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
A. N. Sharpley.
Journal of Environmental Quality, Vol 9, No 4, p 575-578, October/December, 1980. 5 Fig, 3 Tab, 17 Ref.

Descriptors: *Phosphorus, *Rainfall-runoff relationships, Movement, *Storm runoff, Soil chemical properties, Simulated rainfall, Model studies, Nutrients, Watersheds, Water quality, Enzymes, Organic compounds, Soil water, Water pollution, Percolation, Leaching, Path of pollutants, *Okalohoma.

The effect of varying the interval between runoff events on the level of soluble phosphorus was examined under conditions of simulated rainfall in Oklahoma. During each runoff event the levels of soluble phosphorus decreased. When the interval between each pair of runoff events was decreased from 1 day to 5 minutes, the soluble phosphorus levels increased from 0.027 to 0.033 milligrams/liter in Bernow fine sandy loam, and from 0.020 to 0.028 milligrams/liter for Woodward loam soils. This was suspected to be due to a movement of soil water down the profile after the runoff process ended, which caused a reduction in the pool of soluble phosphorus in the surface soil that is susceptible to leaching during runoff. Contrastingly, when event intervals were increased from 1 to 6 days, a marked increase in the mean concentration of soluble phosphorus in runoff was noted. Mean levels of soluble phosphorus under these conditions rose from 0.018 to 0.026 milligrams/liter for Bernow and 0.011 to 0.041 milligrams/liter for Woodward soils. This increase was correlated with the phosphatase enzyme activity of the soils examined, and therefore could be partially due to organic phosphorus mineralization. (Geiger-FRC)
W81-01364

LOSS OF CHLORPHYRIFOS IN POND WATER: EXAMINATION OF RESULTS USING THREE SIMPLE MATHEMATICAL MODELS,
Manitoba Univ., Winnipeg. Pesticide Research Lab.
G. J. Reimer, and G. R. B. Webster.
Journal of Environmental Science and Health, Part B, Vol 15, No 5, p 559-569, 1980. 2 Tab, 7 Ref.

Descriptors: *Chlorpyrifos, *Water pollution, *Pesticide kinetics, Model studies, Mathematical models, Pollutants, Pesticides, Halogenated pesticides, Persistence, Degradation, Ponds.

Two formulations of chlorpyrifos, the active ingredient in Dursban insecticide, were added at the recommended dose of 0.04 mg per 100 liters to outdoor pools during the summer months. Half-life of the emulsifiable concentrate was 5 + or - 3 hours; of slow release granules, 14 + or - 4 hours. This data was analyzed using three simple mathematical models: a power rate model, a hyperbolic rate model, and an empirical power function. The average correlation coefficients were approximately 0.78, 0.84, and 0.76, indicating that all models showed similar performance. (Cassar-FRC)
W81-01366

INVESTIGATIONS OF PIPE-BORNE WATER POLLUTION IN BENIN CITY, NIGERIA,
Benin Univ. (Nigeria). Dept. of Biological Sciences.
E. J-Nkanga.
Water, Air, and Soil Pollution, Vol 13, No 4, p 425-437, December, 1980. 6 fig, 6 Ref.

Descriptors: *Benin City(Nigeria), *Water pollution sources, *Public health, *Bacteria, Water quality, Coliforms, Construction, Plumbing, Domestic wastes, Pipes, Septic tanks, Soil disposal fields, Rainfall, Potable water, *Nigeria.

The source of the high level of bacterial contamination in the public water supply of Benin City, Nigeria, was investigated. The combined effects of rainfall with excessive construction work and the inadequate plumbing codes were identified as the two most important causes of this pollution. Construction on roads, use of an underground sewage collection system, and a telephone cable installation led to frequent water pipe breaks. Samples were taken in 4 main zones characterized, respectively, by extensive road construction, combined construction projects, no public construction, and a residential area using toilets with septic tanks and disposal fields. Samples were also collected at pumping stations and a river to determine the quality of the water before passing through consumer pipelines. Peak rainfall periods corresponded with peak coliform counts in areas of heavy construction. Rainfall had little effect in the area where construction was insignificant. Contamination increased from 12 coliforms per 100 ml to 60 per 100 ml as water lines passed through an area containing septic tanks and drain fields. Artificial contamination studies showed that rainfall increased bacterial count in pipe-borne water passing through absorption fields. (Cassar-FRC)
W81-01372

HEAVY METAL INPUTS TO MISSISSIPPI DELTA SEDIMENTS--A HISTORICAL VIEW,
Texas A and M Univ., College Station. Dept. of Oceanography.
B. J. Presley, J. H. Trefry, and R. F. Shokes.
Water, Air, and Soil Pollution, Vol 13, No 4, p 481-494, December, 1980. 7 Fig, 2 Tab, 34 Ref.

Descriptors: *Heavy metals, *Rivers, Mississippi River, Lead, Cadmium, *Water pollution, Sediments, Zinc, Trace elements, Deltas, Waste dilution, Municipal wastes, Industrial wastes, *Mississippi Delta.

Sampling and analysis of suspended particulates, filtered water, and sediments from the Mississippi River, its delta, and adjacent marshes during 1974-1976 showed that sediment Cd and Pb concentrations increased by 70% and 200% respectively over the past several decades. Particulate matter in the river contains more than 90% of the metal load, which resembles the chemical composition of average rocks in levels of Fe, Al, V, Cr, Cu, Mn, and Ni. However, Pb and Zn are about 3 times more concentrated in river particulates than in the average rock crust; Cd, 7 times. River particulate matter and delta sediments are similar in levels of Al, Fe, Cr, V, Cd, and Pb, but Co, Cu, Mn, Ni, and Zn in sediments are 20 to 40% less, probably due to diagenic losses. Dissolved metal concentrations, similar to world average values for rivers, were below limits for safe drinking water. The Mississippi River is capable of carrying enormous loads of industrial and municipal metal wastes without significantly increasing background metal levels. This is possible because of the abundant suspended matter, high pH, and large volume of water. (Cassar-FRC)
W81-01373

DEVELOPMENT OF A WINTERTIME BIOMONITOR FOR HEAVY METALS IN FLOWING WATERS,
Michigan Technological Univ., Houghton. Dept. of Biological Sciences.
J. M. Glime, and R. R. Keen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157067, Price codes: A04 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, Project Completion Report, January, 1981, 50 p, 4 Fig, 18 Tab, 37 Ref. OWRT A-107-MICH(1), 14-34-0001-0124.

Descriptors: *Bioindicators, *Mosses, *Lake Superior, Monitoring, Water quality, Biomonitor, Winter, Aquatic moss, *Heavy metals, Copper, Cadmium, *Fontinalis, Aquatic toxicology, Alkalinity, Humic acids.

Two species of Fontinalis were cultured at 1 and 5C in Lake Superior water with experimentally varied alkalinity and humic acid, copper and cadmium concentrations, to determine the suitability of using these mosses as wintertime biomonitors for heavy metal contamination. Both species exhibited growth and healthy appearance at 1 and 5C. Alkalinity and humic acids had no significant effect on the chlorophyll content or appearance of the moss within the range of concentrations known in Michigan. Copper caused reduced chlorophyll and visible loss of color at 1 mg/l in four days at 1C. Cadmium caused reduced chlorphyll and visible loss of color only at 35 upsilon g/l and above after 10 days of exposure at 1C. Cellular re-organization paralleled color response to both copper and cadmium. Several species of mosses were compared for ease of recognizing stress symptoms. Fontinalis hypnoides var. duriaei and Eurhynchium riparioides had the most easily recognized macroscopic response.
W81-01374

INDICATOR-ORGANISM PERSISTENCE IN ACID-MINE-WATER ENVIRONMENTS,
West Virginia Univ., Morgantown. Water Research Inst.
N. E. Carlson, and G. K. Bissonnette.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157075, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, 1981. 41 p, 8 Fig, 8 Tab, 58 Ref. OWRT-A-039-WVA(1), 14-34-0001-0152.

Descriptors: *Acid mine water, *Bioindicators, *Coliforms, Microbiology, *Sewage bacteria, Streptococcus, *Water quality, Bacteria, Domestic wastes, E. Coli, Enteric bacteria, Microorganisms, Mine water, Sewage effluents, Waste water(Pollution), Water pollution.

Persistence of indicator organisms (total coliforms, fecal coliforms, and fecal streptococci) associated with natural samples of raw, primary- and secondary-treated sewage was studied following in-situ exposure to five aquatic environments. Three of these streams contained significant amounts of acid mine drainage. The other two streams were relatively uncontaminated. Indicator organisms were rapidly killed upon exposure to the acid-mine systems. In most cases, the survivors were reduced more than 90% within 30 minutes. Little reduction in numbers was observed in the uncontaminated streams. Seasonal changes affected survival of indicators as reflected by slightly prolonged persistence at colder in-situ water temperatures. The fecal coliform group was most susceptible to the acid-mine-water stress. The fecal streptococci were the most persistent. An enrichment technique resulted in substantially enhanced recovery of sublethally-injured survivors of acid stress. Enrichment was particularly beneficial for recovery of acid-injured fecal coliforms. Relatively little improvement in recovery of fecal streptococci was afforded by the enrichment technique.
W81-01378

5C. Effects Of Pollution

OPPORTUNITIES FOR U.S. FISH AND WILDLIFE SERVICE INITIATIVES RELATED TO URANIUM MINING AND MILLING IN THE WESTERN UNITED STATES,
Enviro Control, Inc., Fort Collins, CO.
For primary bibliographic entry see Field 5B.
W81-01216

SANDIA'S ACTIVITIES IN URANIUM MILL TAILINGS REMEDIAL ACTION,
Sandia National Labs., Albuquerque, NM.
For primary bibliographic entry see Field 5B.
W81-01217

SEASONAL FLUCTUATIONS OF MAJOR DIATOM SPECIES AT FIVE STATIONS

ACROSS LAKE MICHIGAN, MAY 1970-OCTOBER 1972,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Sciences.
R. E. Holland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-110975, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-066, July, 1980. 95 p, 33 Ref, 2 Append. R-805133-01-1.

Descriptors: *Lake Michigan, *Diatoms, *Eutrophication, *Seasonal, Phytoplankton, Aquatic environment, Nutrients, Water pollution, Great Lakes, Aquatic productivity, Solar radiation, Summer, Winter, Plant populations, Temporal distribution, Distribution patterns.

Recent investigations have demonstrated significant differences between inshore and offshore waters in Lake Michigan which show that inshore environments are deteriorating at a much faster rate than offshore environments. In the past, conclusions concerning changes in the Great Lakes have been based on data from inshore water samples, and engineering studies have been based upon the assumption that the entire volume of the lake was available for dispersion of pollutants. From 27 May 1980 to 4 October 1972, water samples were collected from five stations on a transect across Lake Michigan from Milwaukee, Wisconsin to Ludington, Michigan. At all stations, diatoms reached their highest abundance in late spring to early summer. These periods of greatest abundance of total diatoms were the result of the rapid growth of one or two species. Stephanodiscus hantzschii was the dominant species at Station 1, off Milwaukee, and Rhizosolenia eriensis was the dominant species or one of the predominant diatom when highest yearly numbers were reached at Stations 3 and 5 in August, 1972. Highest winter numbers were reached at Station 1 on 22 February, 1972 when Stephanodiscus minutus was dominant at all stations. Solar radiation appears to be the limiting factor in the productivity of winter plankton. There were differences between inshore and offshore stations, but Station 1 was most distinct and reflected the continued input of nutrients from the Milwaukee area. (Moore-SRC)
W81-01223

AN EVALUATION OF HAZARDOUS CHEMICALS IN LAKE ONTARIO DURING IFYGL,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
G. F. Lee.
Environmental Protection Agency Report EPA-600/3-80-060, July, 1980. 34 p, 1 Fig, 9 Tab, 8 Ref. R-803187.

Descriptors: *Lake Ontario, *Heavy metals, *Water pollution, *Chlorinated hydrocarbon pesticides, *Polychlorinated biphenyls, Water quality, Great Lakes, Fish, DDT, Cadmium, Zinc, Chromium, Copper, Fluoride, Iron, Lead, Nickel, Manganese, Ammonia, Dieldrin.

Data collected during the International Field Year for the Great Lakes (IFYGL) studies during 1972-73 on Lake Ontario are summarized relative to either recommended International Joint Commission (IJC) Research Advisory Board water quality objectives or Environmental Protection Agency Quality Criteria for Water. Data from 247 stations are summarized for the following parameters: cadmium, zinc, chromium, copper, fluoride, iron, lead, nickel, manganese and ammonia. Almost all reported measurements for total cadmium exceeded the IJC water quality objective of 0.2 microgram/l by at least five times. Values reported for copper also showed a high percentage of measurements equal to or in excess of the recommended IJC water quality objective. Other metals showed more regional patterns of values equalling or exceeding water quality objectives. The concentrations polychlorinated biphenyls, dieldrin and DDT and its metabolites in water and fish were found to exceed both the IJC water quality objectives and the Quality Criteria for Water. The polychlorinated biphenyl content of the water ranged from 40 to 97 ng/l with an average of 55 ng/l, which is 50 times the Quality Criteria for Water. If the IFYGL data are representative of Lake Ontario conditions, studies need to be conducted to evaluate whether these concentrations are indicative of water quality deterioration. (Moore-SRC)
W81-01226

RESULTS OF A LIMNOLOGICAL STUDY OF LAKE POCASSE, SOUTH DAKOTA,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
R. A. Roline, and J. F. LaBounty.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-141905, Price codes: A03 in paper copy, A01 in microfiche. Report REC-ERC-80-4, June, 1980. 47 p, 22 Fig, 16 Tab, 31 Ref.

Descriptors: *Limnology, *Water chemistry, *Heavy metals, *Anaerobic conditions, South Dakota, Water temperature, Dissolved oxygen, Cyanophyta, Primary productivity, Nutrients, Sediments, Zooplankton, Aquatic life, Eutrophication, Copper, Lead, Zinc, Manganese, Iron, Polychlorinated biphenyls, Water pollution, *Lake Pocasse(SD).

In 1977-78, a limnological study was done on Lake Pocasse, South Dakota, to evaluate the present condition of the lake and to assist in the feasibility decision of using the lake as a regulating reservoir. The shallow depth (3 to 4 m) allows for water temperatures during the summer to reach 25 degrees C with very little stratification. The dissolved oxygen in the water is usually maintained at levels adequate for the survival of aquatic organisms during the ice-free period, but may frequently approach anaerobic conditions during winters with heavy snow and ice cover. Potentially toxic levels of the heavy metals copper, lead, zinc, manganese, and iron have been measured, but these elements are usually in the less harmful particulate form. Anaerobic conditions may contribute to the release of the ionic forms of heavy metals which are highly toxic to aquatic life. No insecticides or herbicides were detected in any of the samples except for the Spring Creek sample which contained 0.001 mg/l polychlorinated biphenyls. The levels of nitrogen and phosphorus compounds measured accounted for the high primary production during the late summer and fall. A bloom of the blue-green alga Aphanizomenon flos-aquae (L.) Ralfs occurred during this period. Zooplankton populations generally were greatest during midsummer and the population of benthic organisms continued to increase throughout the season. Lake Pocasse appears to act as a trap for sediments, nutrients, and heavy metals because of limited and irregular flushing. (Moore-SRC)
W81-01238

MOVEMENTS OF LAKE TROUT IN TWIN LAKES, COLORADO, IN RELATION TO THE MT. ELBERT PUMPED-STORAGE POWERPLANT,
Colorado Cooperative Fishery Research Unit., Fort Collins.
L. A. Walch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-130049, Price codes: A04 in paper copy, A01 in microfiche. Engineering and Research Center, Water and Power Resources Service, Report REC-ERC-79-17, July, 1980. 76 p, 15 Fig, 4 Tab, 90 Ref, 9 Append.

Descriptors: *Lake trout, *Fish behavior, *Entrainment, *Pumped storage, Environmental effects, Colorado, Seasonal, Tailrace, Water temperature, Distribution, Movement, Fish management, Powerplants, Reservoirs, Diurnal distribution, Depth, *Twin Lakes(CO).

Mean movement rates of 34 lake trout (Salvelinus namaycush) tagged with ultrasonic transmitters in Twin Lakes, Colorado, ranged from 1.1 m/min in the fall to 1.6 m/min in the summer. Movement rates between 0830 and 1130 were significantly higher than between 2230 and 0500 during spring, summer, and fall. During the fall, afternoon movements were significantly greater than night movements. Home range sizes of lake trout were larger during the spring, summer, and fall than during the winter. Of the home ranges observed, at least 40% were found in the proximity of the tailrace at all times of the year. More excursions out of home ranges occurred during the spring and fall than during the summer or winter. Gill netting data indicated that lake trout were more likely to be found near the tailrace during spring and fall than during summer or winter. During the summer, lake trout were found to prefer deep areas of the lower lake. Between July and October, they occupied depths where water temperatures in the lower and upper lakes averaged 10.5 and 8.5 degrees C, respectively. Few excursions into water warmer than 12 degrees C occurred. Most lake trout were found within 3 m of the bottom. Movements of fish to within 15 m of shore occurred in all seasons and usually took place between 0600 and 1300. Ripe lake trout were captured at depths ranging from 1.5 to 12 m, but were not captured near the powerplant. It is likely that the lake trout of Twin Lakes will be least vulnerable to entrainment by pumping operations between 2230 and 0500 and most vulnerable between 0830 and 1130 during spring, summer, and fall. Seasonally, they will be least vulnerable in the winter and most vulnerable in the spring.
W81-01239

RELATIVE EFFECTS OF BACTERIAL AND PROTOZOAN PREDATORS ON SURVIVAL OF ESCHERICHIA COLI IN ESTUARINE WATER SAMPLES,
Tasmania Univ., Hobart (Australia). Faculty of Agricultural Science.
J. McCambridge, and T. A. McMeekin.
Applied and Environmental Microbiology, Vol 40, No 5, p 907-911, November, 1980. 1 Fig, 2 Tab, 16 Ref.

Descriptors: *Estuaries, *Coliforms, *Predation, Aquatic habitat, Estuarine environment, Bacteria, Sea water, Microorganisms, E. coli, Sewage bacteria, Cultures, Protozoa, Aquatic life, Microbiology.

The relative effect of protozoan and bacterial predators on the survival of Escherichia coli in estuarine water samples was examined. A bacterial suspension was added to fresh estuarine water samples, and antibiotics were added to determine the effect of bacterial predators alone. The time interval during which predacious protozoa were active in a 10-day-decline period was determined by the exposure of Escherichia coli to these predators for different lengths of time. After this exposure, protozoan predators were inhibited for the remainder of the experiment. Predacious protozoa were found to exert their major influence during the first two days of the decline period. The early effect of protozoa and the suppression of bacterial predators by these protozoa suggest that there may be interacting microbial predators, each playing a distinct role in the destruction of fecal bacteria after their introduction into estuarine conditions. (Titus-FRC)
W81-01247

LIMNOLOGICAL STUDIES ON INORGANIC ACID LAKES IN JAPAN (IN JAPANESE),
National Inst. for Environmental Studies, Yatabe, (Japan).
For primary bibliographic entry see Field 2H.
W81-01266

TEMPORARY PIPELINE AVERTS WATER QUALITY EMERGENCY.
For primary bibliographic entry see Field 5G.
W81-01284

EFFECT OF THE WARM WATER DISCHARGE FROM A POWER STATION ON FISH POPULATIONS IN THE RIVER TRENT,
Central Electricity Generating Board, Ratcliffe-on-Soar (England). Freshwater Biology Unit.
K. Sadler.
Journal of Applied Ecology, Vol 17, No 2, p 349-357, August, 1980. 3 Fig, 4 Tab, 20 Ref.

Descriptors: *Fish, *Water discharge, *Temperature, Heated water, Water temperature, Perches,

Fish behavior, Fish populations, Ecology, Operation and maintenance, Thermal properties, Fish migration, Aquatic environment, Environmental effects, *Power plants, England, River Trent(England).

Seine netting was conducted monthly at stations above and below a power station to determine the effect of warm water discharge on fish populations. Nine species of fish were tracked, three in statistically significant quantities. Statistical tests were conducted where possible. Results indicate that fish population densities and species diversity were greater downstream in warmer waters. Reduction in catch during the winter months suggests a seasonal migration. This reduction occurred in December in the downstream site, 1 to 2 months later than in the upstream site. Temperature increments caused by power station operation were a mean value of 6 to 8 degrees Centigrade above ambient, with a peak of 28C. Literature data indicates that 30C is the point at which thermal stress in fish appears. (Titus-FRC)
W81-01286

EFFECT OF VARYING MG/CA RATIO AND ELECTROLYTE CONCENTRATION IN THE IRRIGATION WATER ON THE SOIL PROPERTIES AND GROWTH OF WHEAT,
Central Soil Salinity Research Inst., Karnal (India).
J. S. P. Yadav, and I. K. Girdhar.
Plant and Soil, Vol 56, No 3, p 413-427, September, 1980. 5 Fig, 7 Tab, 23 Ref.

Descriptors: *Wheat, *Irrigation water, Magnesium, Water quality, Calcium, Soil properties, Salinity, Electrolytes, *Crop response.

The effect of irrigation waters having varying Mg/Ca ratios (2, 4, 8, and 16) and electrolyte concentrations (20 and 80 meq/liter) on growth of wheat in pots was studied using two different soils. The two soils were a heavy-textured black soil dominated by montmorillonite clay and a light-textured alluvial soil with illite type clay. As irrigation water of higher electrolyte concentration was used, salinity increased. The rate of increase was greater in the heavy soil. Soluble salts accumulated in the surface layers of both soils when saline water was applied. As the Mg/Ca ratio and electrolyte concentration of the irrigation water increased, the Na and Mg absorption in the soils increased, and the wheat crop was significantly reduced. Effects were more pronounced in the heavy soil than in the light alluvial soil. Soil pH increased with increases in Mg/Ca ratio and decreased with increases in electrolyte concentration. Soil pH was higher in the surface layer than in the subsurface layer. (Cassar-FRC)
W81-01305

AN EQUITABLE APPROACH TO POLLUTION CONTROL WITH PARTICULAR REFERENCE TO THE THAMES ESTUARY,
Thames Water Authority, London (England). Directorate of Scientific Services.
L. B. Wood, and A. G. Cockburn.
Progress in Water Technology, Vol 12, No 3, p 83-91, 1980. 3 Fig, 1 Tab, 4 Ref.

Descriptors: *Equity, *Oxygen requirements, *Estuaries, Dissolved oxygen, Fish, *Water pollution control, Salinity, Flow, Mathematical models, Rivers, Thames River(England), England.

The preparation of the pollution budget for the Thames Estuary is described with special reference to biodegradable loads. Also, the extension of the procedure to other substances is discussed. The Thames Estuary is divided into three salinity zones: Canvey Island to the North Sea, London Bridge to Canvey Island, and Teddington to London Bridge. In the first zone, the minimum percentage of air saturation with dissolved oxygen must be at least 60% in 95% of the samples collected. The water must be suitable for the whole life cycle of marine organisms. In the second zone, dissolved oxygen must be at least 40% in 95% of the samples, and the water must be non-toxic to fish. The dissolved oxygen pollution budget is related to the effects of biodegradable discharges in the third quarter of the year. The parameter for measuring potential pollution load is the Effective Oxygen Load, which equals 3/2 times the oxidizable nitrogen in mg/liter, times the flow rate in cu m/day, times 10 to the sixth power. Mathematical modelling using the steady-state model (Barrett, Mollowney, and Casapieri, 1978) is used to evaluate the discharge standards for an effluent in a particular area. (Small-FRC)
W81-01313

THE STATE OF THE NILE ENVIRONMENT: AN OVERVIEW,
United Nations Environmental Programme, Nairobi (Kenya).
E. E. El-Hinnawi.
Water Supply and Management, Vol 4, No 1-2, p 1-11, 1980. 2 Fig, 1 Tab, 18 Ref.

Descriptors: *Rivers, *Environmental effects, *Dam construction, Lakes, Watersheds(Basins), Eutrophication, Aquatic plants, Bacteria, Dissolved oxygen, Human diseases, *Nile River, Kenya.

The main environmental changes that have occurred or are anticipated as a result of development of the Nile basin are reviewed. The most important environmental impacts are related to the construction of dams and the creation of manmade lakes. The filling of a new lake causes geochemical and biochemical changes such as stratification, eutrophication, bacterial growth, and deoxygenation. Water hyacinth, water fern and water lettuce increase water loss by evaporation and use nutrients which could be used by fish. Placid lake waters as well as the rapid flows through dam sluices have aided the spread of water-borne human disease. The concept of ecodevelopment is explained, and monitoring is urged to protect the Nile, one of the world's least polluted rivers. (Small-FRC)
W81-01327

WATER SUPPLY PROBLEMS IN THE CONSTRUCTION AND OPERATION OF AN OIL PIPELINE: A CASE STUDY OF THE SAINT LAWRENCE LOWLANDS,
Institut National de la Recherche Scientifique, Rimouski (Quebec).
D. Couillard.
Water Supply and Management, Vol 4, No 5/6, p 397-407, 1980. 1 Fig, 1 Tab, 22 Ref.

Descriptors: *Potable water, *Oil spills, *St. Lawrence River, Quebec, Groundwater, Water pollution sources, Pipelines, Rivers, Water quality, Oil industry, Engineering structures, Leakage, Environmental effects, Pollution.

Effects of oil spills from construction and operation of a proposed petroleum pipeline and tank farms on the south shore of the St. Lawrence River, Quebec, on the water supply in this area are discussed. Within the study area there are over 75 localities which draw their water supply from rivers. Twenty-seven communities and numerous individual households depend on groundwater. The quality of river water and groundwater varies but is generally good. The most serious result of oil leakage into the environment would be contamination of the groundwater. In sand and gravel aquifers, pollution disperses quickly over a large region and degrades very slowly. Since the pipeline will cross many water courses, a spill could contaminate a community's water potable supply and adversely affect aquatic life. Chlorination of a water source containing even trace amounts of oil can produce phenolic compounds with disagreeable taste and odor. Contamination of rivers disperses more quickly than in groundwater. Nevertheless, emergency plans and alternative sources should be formulated by each community. A temporary adverse effect of pipeline construction is increased sediment loads in the water. (Cassar-FRC)
W81-01332

DETRIMENTAL EFFECTS OF PHARMACEUTICAL INDUSTRIAL WASTE ON MICROORGANISMS,
Z. H. Coll. of Engineering and Technology, Aligarh (India). Environmental Research Lab.
M. Ajmal, A. Ahmad, M. Z. Hasan, and A. A. Nomani.
Water, Air, and Soil Pollution, Vol 13, No 4, p 447-452, December, 1980. 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Microorganisms, *Industrial wastes, *Pollutants, Bacteria, Antibiotics, Chemical wastes, *Pharmaceutical wastes, Environmental effects.

A sample of industrial waste from Cooper Pharma Limited, Ghaziabad, India, manufacturer of products including vitamins, aspirin, and anitbiotics, was analyzed and its effects on microorganisms determined. The pungent, yellow material, pH 5.5, had the following properties, expressed in mg per liter: suspended solids, 455; total solids, 2520; dissolved solids, 1780; and turbidity, 985. Chemical properties, also listed in mg per liter, were: BOD, 390; COD, 1850; organic nitrogen, 24; inorganic nitrogen, 12.5; sulfur, 5.1; chlorides, 14.9; sulfates, 9.5; phosphates, 4.2; volatile solids, 280; and dissolved oxygen, nil. Varying volumes of the waste, ranging from 0.5 ml to 12 ml, were added to 300 ml BOD bottles, which were then filled with distilled water. Bacterial cultures, saprophytic, nitrifying, and a combination of both, were added. Results showed that 0.5 ml of waste had no detrimental effects on any bacteria. Slight effects were noticed at 1 or 2 ml. Definite detrimental effects were seen at 10 to 12 ml for each bacterium separately and in combination. The author suggests that large volumes of pharmaceutical industrial waste should not be discharged into the environment without dilution or treatment. (Cassar-FRC)
W81-01353

DOES DRINKING WATER HARDNESS AFFECT CARDIOVASCULAR DISEASE,
Delaware Div. of Public Health, Dover.
M. Joyce.
Journal of Environmental Health, Vol 43, No 3, p 134-139, November/December, 1980. 6 Tab, 16 Ref.

Descriptors: *Potable water, *Cardiovascular disease, *Hardness(Water), Magnesium, Calcium, Public health, Water quality, Metals, Trace elements.

The relationship of drinking water hardness to cardiovascular disease is reviewed by examining published literature. Higher cardiovascular disease mortality rates are found in soft water areas than in hard water areas. General conclusions are that hard water may lower intestinal absorption of toxic metals, trace elements (chromium, vanadium, lithium) normally associated with hard water may contribute to proper nutrition and better general health, and the corrosive effect of soft water may cause higher levels of harmful materials (lead, cadmium, and copper) in drinking water. Calcium and magnesium, common constituents of hard water, appear to have a protective effect against cardiovascular disease. If further clarification of these relationships proves that cardiovascular disease is caused by certain drinking water trace elements, current water treatment practices should be modified. (Cassar-FRC)
W81-01362

THE EFFECTS AND CONTROL OF ALGAL BLOOMS IN FISH PONDS,
Centre Technique du Genie Rural, Monpellier (France). Amenagements Littoraux et Aquaculture.
E. A. Seymour.
Aquaculture, Vol 19, No 1, p 55-74, January, 1980. 2 Fig, 5 Tab, 55 Ref.

Descriptors: *Cyanophyta, *Carp, *Ammonia, Nitrogen, Phosphorus, Aquatic algae, Aquatic weed control, Algal toxins, Fisheries, France, *Fish ponds.

The development of a dense bloom of a blue green alga (Aphanizomenon flos-aquae) in the ponds of a carp farm in the south of France was investigated. Temperature, surface dissolved oxygen, hardness,

and total inorganic nitrogen content of the pond water were measured throughout the season. Changes in the cover of macrophytes in the pond were also determined. About one day after the collapse of the bloom, carp gathered at the inflow to the pond, where they gasped at the surface. Ten days after the bloom collapse, netted carp had distended abdomens and internal hemorrhages. Twenty-one days after the bloom collapse, 10-20% of the carp had skin lesions and other problems. Total carp mortality was only 11%. Concentrations of non-ionized ammonia in the pond were measured after the bloom. These measurements, along with earlier laboratory findings, indicated that infectious dropsy of carp is caused by ammonia. It is suggested that dense blooms of nitrogen-fixing algae can be controlled by manipulation of the nitrogen-phosphorus balance of ponds. (Small-FRC)
W81-01418

5D. Waste Treatment Processes

CAPTURE OF LATEX BEADS, BACTERIA, ENDOTOXIN, AND VIRUSES BY CHARGE-MODIFIED FILTERS,
AMF Cuno, Meriden, CT.
K. Hou, C. P. Gerba, S. M. Goyal, and K. S. Zerda.
Applied and Environmental Microbiology, Vol 40, No 5, p 892-896, November, 1980. 5 Fig, 4 Tab, 12 Ref.

Descriptors: *Filtration, *Microorganisms, Methodology, Filters, Water pollution, Water quality, Kinetics, Laboratory tests, Bacteria, Flow, Waste water treatment, *Water treatment.

A study of filtration methods indicates that electropositive filters are effective in the removal of a wide range of microorganisms over a wide range of pH values and ionic conditions. The use of these filters has potential application in the removal of microorganisms from water, concentration of both bacteria and viruses from water, and harvesting for removal of endotoxins from contaminated parenterals and foods and for immobilization of microbial cells and antigens. These filters depend upon electrokinetic effects on microorganisms and suspended matter which exhibit a net negative charge in most fluids. Electronegative filters of similar porosity and electropositive filters that had been treated to destroy the charge were ineffective under similar conditions. (Titus-FRC)
W81-01240

HANDLING HAZARDOUS WASTES,
Battelle-Columbus, OH.
For primary bibliographic entry see Field 5E.
W81-01263

FULL-SCALE EVALUATION OF HIGH RATE SCREENING DEVICES FOR TREATMENT OF SANITARY SEWAGE BY-PASS FLOW,
Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
H. Kronis, and F. Tonelli.
Environment Canada, Canada-Ontario Agreement on Great Lakes Water Quality Research, Report No 103, 1980. 145 p, 33 Fig, 25 Tab, 11 Ref, 3 Append.

Descriptors: *Bypasses, *Sewage treatment, *Sanitary engineering, *Waste water(Pollution), *Screens, Canada, Infiltration, Flow rates, Routing, Spillways, Channels, Floodways, Disposal, Civil engineering, Effluents, Treatment, Sewage, Wastes, Equipment, Filters, Sieves, Size, Peak discharge, Water pollution control, Storm surge, Technology.

Four fine-mesh high-rate screening devices were evaluated for their ability to treat combined sewage from wet and dry weather conditions. The devices tested were: a 1.5 meter diameter Centrifugal Waste water Concentrator with 105 micrometer screen openings, a 1.5 meter long rotating horizontal drum screen (Rotostrainer) with 500 micrometer apertures, and two stationary inclined screens (one, a 0.6 meter wide stationary hydraulic sieve, the other, a 1.8 meter wide Hydrasieve, having 305 and 762 micrometer apertures, respectively). The study was conducted during 1974-75 at the Belleville, Ontario Water Pollution Control Plant, where influent sewage is subject to substantial infiltration, dilution, and flow peaking during wet weather. Observed hydraulic capacity (16-50 gallons per minute-square foot) and pollutant removal depended largely on screening device type, aperture size, and availability of an effective backwash system. Typical mean pollutant removals during storm events with first flush conditions were: 5-32% for suspended solids, 5-24% for BOD-5, and 23-79% for settleable solids. Pollutant reductions were much less in dry weather. Operating costs (0.6-19 cents/1000 gallons) depended on several factors. It was concluded that screening had potential for pollutant reduction in combined sewer flows. (Zielinski-IPA)
W81-01267

NUTRIENT REMOVAL FROM DRAINAGE WATERS WITH SYSTEMS CONTAINING AQUATIC MACROPHYTES,
Florida Univ., Sanford. Inst. of Food and Agricultural Sciences.
L. R. Sinclair, and R. B. Forbes.
Transactions of the ASAE, Vol 23, No 5, p 1189-1194, October/November, 1980. 1 Fig, 4 Tab, 21 Ref.

Descriptors: *Water pollution treatment, *Aquatic plants, *Lake Apopka(FL), *Nutrient removal, Water quality, Drainage water, Biological treatment, Water treatment, Water hyacinth, Swamps, Muck soils, Najus, Eutrophication.

Water quality was measured at the inflow and outflow of three treatment systems to determine their effectiveness in removing nutrients from agricultural drainage water. The study was adjacent to Lake Apopka, Florida, which has undergone eutrophication during the past 50 years from nutrients added by drainage water from muck farming. A natural swamp was not very effective in improving water quality. Turbidity, sulfate, pH, and nitrates were slightly reduced, and alkalinity, ammonia, phosphate, tannin-lignin, carbon dioxide, and temperature increased slightly. Oxygen concentration decreased significantly. An anerobic system, floating water hyacinths planted in a 16.2 hectare reservoir, improved water quality slightly through the growing season. Nitrates, oxygen, phosphates, and sulfate decreased; other changes were not statistically significant. This method was most effective of the three in nitrate removal. After the water hyacinths started to decay, water quality degenerated. A 0.4 hectare recycle reservoir containing Najus, submerged plants, removed nutrients very effectively. In this aerobic process, alkalinity, ammonia, carbon dioxide, phosphate, tannin-lignin, turbidity, and sulfate decreased significantly, and oxygen and pH increased significantly. This system was effective in winter. The author speculated that a combination of naiad and hyacinth systems might produce improved results. The possibility of using emergent plants such as cat tails was also mentioned. (Cassar-FRC)
W81-01270

FLUID MECHANICS-FOAM FLOTATION INTERACTIONS,
Nevada Univ. System, Las Vegas. Water Resources Center.
R. M. French, and D. J. Wilson.
Separation Science and Technology, Vol 15, No 5, p 1213-1227, June, 1980. 6 Fig, 2 Tab, 10 Ref.

Descriptors: *Mathematical models, *Flotation, Froth flotation, Water pollution treatment, *Fluid mechanics, *Waste water treatment.

A simple mathematical model for describing the interaction of fluid mechanics and surface chemistry in particle attachment to bubbles in foam flotation columns is suggested. This information is insignificant in the study of pollutant removal from waste waters by foam flotation. This model, an air bubble with a single attached floc particle rising in a Stokes flow regime through a liquid pool at the bottom of a batch foam flotation column, was used to calculate the viscous forces acting to separate bubble and particle. Comparisons with previous work showed that magnitudes, but not directions, of viscous forces can be correctly estimated. (Cassar-FRC)
W81-01280

REVERSE OSMOSIS SEPARATION OF THIOSALTS FROM MINING EFFLUENTS,
Barringer Magenta Ltd., Rexdale (Ontario).
K. S. Subramanian, M. Malaiyandi, and V. S. Sastri.
Separation Science and Technology, Vol 15, No 5, p 1205-1211, June, 1980. 6 Tab, 10 Ref.

Descriptors: *Reverse osmosis, *Sulfur compounds, *Mine wastes, *Metals, *Waste water treatment, Membrane processes, Separation techniques, Sulfates, Industrial wastes, Chemical wastes, Effluents, Cellulose acetate.

Reverse osmosis using a cellulose acetate membrane was evaluated as a possible method for removal of thiosalts from mine tailings ponds. Separation of sodium sulfate, sodium thiosulfate, sodium dithionate, potassium thrithionate, and potassium tetrathionate reached a maximum at 300 psig. Separation efficiencies ranged from 82.2% to 92.9%. Twelve plant effluents containing varying thiosalts and metal ions were subjected to reverse osmosis at 300 psig. Tables listing concentrations of each ion before and after treatment indicate that a large percentage of contaminants were removed. Effluent waters were analyzed for metal ion content and found satisfactory for recycling in the plant or discharge into nearby streams. (Cassar-FRC)
W81-01281

WATER HYACINTHS FOR WASTE WATER TREATMENT,
Boyle Engineering Corp., Orlando, FL.
H. W. Haeseker, and S. C. Helle.
Public Works, Vol 111, No 12, p 34-36, December, 1980.

Descriptors: *Water hyacinth, *Waste water treatment, *Effluents, Water levels, Pilot plant, Biochemical oxygen demand, Water balance, Flow, Water pollution, Aquatic plants, Secondary treatment, Tertiary treatment.

The effectiveness of water hyacinths for waste water treatment is discussed. Water hyacinths grow rapidly in nutrient-rich water, producing biomass which can be digested to generate fuel gas or used as a protein source for animals and perhaps humans. The harvested plants can also be composted to produce an organic soil conditioner. Tests in a pilot waste treatment plant in Florida demonstrated that hyacinths have viable potential for waste treatment. Concentrations of total suspended solids and biological oxygen demand were reduced 80 to 90% with an effluent detention period of 5 days. Effluent was applied at rates of 17,000 gallons per day through three channels. Hyacinths were harvested once a month. Loading rates for secondary and tertiary treatment, cost-benefit analyses, and water budgets remain to be determined. (Titus-FRC)
W81-01285

KINETICS OF PURE OXYGEN ACTIVATED SLUDGE,
Technion - Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
G. Shelef, and M. Green.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE6, p 1099-1110, December, 1980. 7 Fig, 4 Tab, 20 Ref.

Descriptors: *Activated sludge, *Aeration, *Kinetics, Oxygen, Sewage treatment, Growth rates, Solubility, Biomass, Dissolved oxygen, Degradation, Wastes, Waste water, Evaluation.

Experiments comparing activated sludge systems aerated by air with those aerated by pure oxygen

found the following kinetic parameters to be identical: yield coefficient, decay coefficient, and substrate removal coefficient. The two systems operated under identical conditions with the exception of dissolved oxygen concentrations, which ranged from 0.3 to 3.0 milligrams per liter in the air system and from 10 to 18 milligrams per liter in the oxygen system. No differences in sludge settling characteristics were noted. Contrary to some claims, the results indicate that the sole advantages of pure oxygen are due to higher partial pressure and the corresponding force of its dissolution. (Titus-FRC)
W81-01297

UPGRADING LAGOON EFFLUENTS WITH ROCK FILTERS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
G. R. Swanson, and K. J. Williamson.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE6, p 1111-1129, December, 1980. 8 Fig, 3 Tab, 19 Ref.

Descriptors: *Algae, *Lagoons, *Sewage treatment, Filtration, Effluents, Filter stones, Oregon, Rocks, Sedimentation, Water pollution, Water quality, Filters, Operation and maintenance, Model studies, Mathematical models, Sewage effluents.

Rock filtration is an effective, low-cost unit process for removing algae from effluents and correspondingly upgrading lagoon treatment. It consists of a submerged bed of rocks through which lagoon effluent passes horizontally. Sedimentation is the primary mechanism of algae removal. A mathematical model of the sedimentation mechanism indicated that total suspended solids removal efficiency is a function of the distribution of algal settling distance in the rock filter. Weekly average effluent biochemical oxygen demand and total suspended solids from the pilot facility in Oregon did not exceed 20 milligrams per liter during a one year study, and settling rates averaged 0.05 meters per day. Rock filters require a minimum of labor for operation and maintenance, and appear to be compatible with typical lagoon facilities. (Titus-FRC)
W81-01298

LIQUID WASTE REDUCTION TECHNOLOGY FOR INDUSTRIES DEMONSTRATED BY THE TREATMENT OF SUGAR BEET WASTE WATER,
Technische Hochschule, Vienna (Austria). Inst. fuer Wasserversorgung Abwasserreiningung und Gewasserschuts.
H. Kroiss.
Progress in Water Technology, Vol 12, No 3, p 263-270, 1980. 6 Fig, 1 Tab, 6 Ref.

Descriptors: *Food processing industry, *Anaerobic digestion, *Aerobic treatment, Activated sludge, *Waste water treatment, Recirculated water, Industrial wastes, Costs, Municipal wastes, Combined treatment, *Sugar beet industry.

Internal and external measures used in the sugar beet industry to reduce liquid wastes are described, and cost estimates are provided. Internal measures, or measures taken during sugar beet processing, include multiple usage of fresh water and simultaneous treatment of the waste water with activated sludge. Effluent quality averages BOD less than 15 mg/liter and COD less than 60 mg/liter after internal biological treatment. Secondary waste water treatment can be applied if internal measures are limited to the removal of settable solids by primary sedimentation and reuse of the mechanically treated waste water for fluming and washing the beets. Several suggested treatment schemes are: (1) Combined treatment in a municipal treatment plant, (2) High rate anaerobic treatment with consecutive treatment in a municipal treatment plant, (3) High rate aerobic treatment with consecutive treatment in a municipal treatment plant, and (4) Low rate aerobic treatment. Costs have been estimated for each. Climbing energy costs make high rate anaerobic treatment attractive. (Small-FRC)
W81-01307

A DESIGN STUDY OF BIOCHEMICAL COMBINED WASTE WATER TREATMENT PLANT,
National Water Board of Finland, Helsinki. Tampere Water District.
P. Rantala.
Progress in Water Technology, Vol 12, No 3, p 271-278, 1980.

Descriptors: *Chemical precipitation, *Trickling filters, *Municipal wastes, Aluminum, On-site investigations, Industrial wastes, Design, Treatment facilities, Finland, Combined treatment, *Waste water treatment.

The design study for upgrading a chemical waste water treatment plant for the city of Tampere (Finland) is described, which evaluated various process modifications. Three modifications were tested which could reach the required effluent standards of BOD less than 25 mg/liter and total phosphorus under 1 mg/liter. Pilot plant studies were carried out over a period of three and one half years for the following: (1) trickling filter with plastic media (Flocor) - post precipitation with aluminum sulfate; (2) simultaneous precipitation, activated sludge with simultaneous ferrous precipitation and a possible pre-precipitation, with existing treatment plant; and (3) simultaneous precipitation with post precipitation with aluminum sulfate. During the tests, the average influent BOD was 250 mg/liter, total phosphorus 8 mg/liter, and suspended solids 300 mg/liter. Simultaneous precipitation was the most economical process for the upgrade. Primary sedimentation could make the process more stable. Good nitrification, however, was not provided. Also, laboratory tests of combined municipal wastes and effluent from a cardboard mill indicated that the two wastes could be treated with no problems. (Small-FRC)
W81-01311

COMPARISON OF CONVENTIONAL INLAND SEWAGE TREATMENT PROCESSES WITH MARINE TREATMENT BY LONG OUTFALLS IN THE YUGOSLAV ADRIATIC REGION,
Taylor (John) and Sons, London (England).
A. J. Price.
Progress in Water Technology, Vol 12, No 1, p 263-277, 1980. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Outfall sewers, *Waste water treatment, *Oceans, Dilution, *Sewage treatment, Coliforms, Public health, Water pollution sources, Adriatic Sea, Yugoslavia.

The relative merits of providing sewage treatment by conventional inland means and by means of ocean dumping through long outfalls are considered. Satisfactory sewage treatment is necessary to protect the fisheries industry, encourage continued development and tourism in the area, and promote public health. Average figures are presented for effluent quality, and different acceptable methods of inland treatment and sludge treatment are outlined. Marine treatment, dilution and purification of sewage after screening and releasing into the water are outlined. After one half to two hours, most coliform bacteria die when exposed to sun and sea water. After two hours, the natural dilution of the sewage can be as great as 1000 fold. A properly designed marine treatment produces a satisfactory degree of treatment and should be considered for the Yugoslav Adriatic. (Small-FRC)
W81-01314

SCHEME FOR REMEDYING THE EFFECTS OF STORM SEWAGE OVERFLOWS TO THE TIDAL RIVER THAMES,
Thames Water Authority, London (England).
L. B. Wood, P. F. Borrows, and M. R. Whiteland.
Progress in Water Technology, Vol 12, No 3, p 93-107, 1980. 3 Fig, 2 Tab, 6 Ref, 4 Append.

Descriptors: *Oxygenation, *Storm runoff, Dissolved oxygen, Oxygen sag, Urban runoff, Storm drains, Fish kill, Rivers, Absorption, Thames River, United Kingdom.

Storm sewer overflows in London which coincided with certain tidal conditions caused severe dissolved oxygen depletions and fish kills. A solution to this situation is presented. Injection of pure oxygen using a pressure swing adsorption unit applied from a Vitox system on a barge which follows the minimum oxygen sag curve as it moves down river is proposed. One recent storm (1977) discharged a total of 3.9 million tons of storm sewage which resulted in a large fish kill. Dissolved oxygen curves for the day before the storm, the day of the storm, and six days after the storm indicated that insufficient oxygen killed the fish. Compensation by the addition of oxygen could be accomplished by oxygenating the sewage discharges as they pass through discharge stations, oxygenating tributaries, oxygenating power station cooling water, or injection of oxygen in the river at various points. Injection of oxygen by a moving barge will be tested in 1980. (Small-FRC)
W81-01316

TRADE EFFLUENT CONTROL IN LONDON,
Thames Water Authority, London (England). Metropolitan Public Health Div.
L. H. Thompson.
Progress in Water Technology, Vol 12, No 3, p 69-76, 1980. 8 Fig.

Descriptors: *Industrial wastes, *Regulation, *Costs, Industrial water, *Effluents, Waste water treatment, Cadmium, Heavy metals, Sludge disposal, London, United Kingdom.

Under current United Kingdom law, Water Authorities must control industrial effluents under a consent procedure. Industry must give advance notice of intent to discharge wastes into waterways, and Water Authorities can prohibit or limit the discharge of various substances. Effluent control is designed to protect the environment as well as the waste water treatment facilities and personnel. The volumes of industrial effluents in London today are presented. These vary from almost 100 cu m x 10 to the third power per working day for the brewing and food processing industry to less than 10 cu m x 10 to the third power per working day for textiles and tanning. The annual cost of treatment is less than 1500 British Pounds Sterling for the average industrial location. The control of heavy metals, particularly cadmium, in waste sludges is discussed. The current limit for cadmium in waste effluents is set at 1 mg/liter. When standards are met, the sludge can be disposed of on land. (Small-FRC)
W81-01317

INDUSTRIAL WASTE CONTROL PROCEDURES IN THE CITY OF LOS ANGELES, CALIFORNIA, U.S.A.,
Los Angeles Bureau of Sanitation, CA.
W. F. Garber.
Progress in Water Technology, Vol 12, No 3, p 23-55, 1980. 1 Fig, 7 Tab, 2 Ref, 2 Append.

Descriptors: *Industrial wastes, *Toxins, *Water pollution sources, Water pollution control, California, Cities, Regulation, Municipal wastes, Domestic wastes, Los Angeles, Non-point pollution.

The point source industrial waste control system of Los Angeles, California, which has been in operation since 1950, presently achieves almost complete control. This well-run, well organized industrial waste control program operating under city, state and federal controls is described. Control of non-point sources including domestic inputs or those which may infiltrate past manhole covers is to some degree impossible in Los Angeles. Regulations for the control of toxins must recognize these non-point background levels. If water quality standards are based on zero risk, the only way to control non-point emissions may be to eliminate the manufacture or use of the offending toxin. Minimum background levels for non-point sources are urged. Industrial waste sources in the Los Angeles area are detailed. (Small-FRC)
W81-01318

ECONOMICAL CONSIDERATIONS ON LOCAL OR CENTRALIZED WASTE WATER TREATMENT SYSTEMS,

Ruhrverband, Essen (Germany, F.R.).
For primary bibliographic entry see Field 6B.
W81-01319

WHICH PLANT EXPANSION IS THE MOST URGENT ONE IN A RIVER SYSTEM AND HOW TO DEVELOP A PRIORITY LIST,
Ruhrverband, Essen (Germany, F.R.).
For primary bibliographic entry see Field 6A.
W81-01320

USE OF MATHEMATICAL MODELS TO DERIVE A SYSTEM FOR CALCULATING THE ACCEPTANCE CAPACITY OF MARINE COASTAL WATERS. (UTILISATION DE MODELES MATHEMATIQUES DANS LA MISE AU POINT D'UNE METHODOLOGIE DE CALCUL DE LA CAPACITE D'ACCEPTATION DU MILIEU RECEPTEUR LITTORAL MARIN.),
Ingenieur General des Ponts et Chaussees, Grenoble (France).
For primary bibliographic entry see Field 5E.
W81-01321

INNOVATION SIMPLIFIES CONSTRUCTION AND TREATMENT,
O'Brien and Gere Engineers, Inc., Syracuse, NY.
B. N. Gidlow.
Water and Wastes Engineering, Vol 17, No 11, p 25-27, 31, November, 1980. 2 Fig.

Descriptors: *Waste water treatment, *Treatment facilities, Tertiary treatment, *Sewage treatment, Sludge disposal, Computers, Water pollution control, Lakes, Industrial wastes, Water pollution, Costs, Chlorination, Sludge treatment, Phosphorus, Syracuse(NY), New York, Onondaga Lake(NY).

The renovation of the Metropolitan Syracuse Sewage Treatment Plant has been completed, and some innovations of the facility and its expanded uses are described. The plant will help to improve the quality of Onondaga Lake through its new tertiary treatment procedures for industrial effluents. The $92 million expansion provided for installation of an extensive computer control system and for phosphate removal facilities which utilize industrial wastes. The facility has the world's longest prestressed concrete piles to support 26 new process structures, phosphate removal areas, and sludge disposal and waste beds. Pilot plant studies were used to arrive at the most suitable treatment procedures for the area, which finally included primary treatment, secondary treatment, chlorination, tertiary treatment, discharge and sludge handling units. Preliminary treatment areas and low lift pumps are also part of the on-site equipment. Sludge gas produced as a byproduct of sludge digestion is stored to fuel the plant's boiler. Sludge may also be picked up by trucks after dewatering for deposit at landfills. Plans for computer handling of storm overflow by remote control are currently being implemented at the new Syracuse facility. (Geiger-FRC)
W81-01325

ENERGY CONSERVATION UNITS REPLACE OIL AT SOUTHERLY WASTE WATER TREATMENT CENTER,
Pirnie (Malcolm), Inc., White Plains, NY.
For primary bibliographic entry see Field 5E.
W81-01336

WASTE WATER FRACTIONS ADD TO TOTAL TREATMENT PICTURE,
Water and Pollution Control Dept. Saskatoon (Saskatchewan).
R. Munch, C. P. Hwang, and T. H. Lackie.
Water and Sewage Works, Vol 127, No 12, p 49, 50, 53, 54, December, 1980. 7 Fig, 4 Tab, 11 Ref.

Descriptors: *Waste water treatment, *Sewage treatment, Saskatoon, Saskatchewan, Colloids, Phosphorus, Nitrogen, Grease, Metals, Canada.

Composition of raw sewage influent at the Saskatoon, Saskatchewan, treatment plant was determined by sampling during February, May, and October in order to obtain information for advanced treatment design. These results were compared with analyses of primary and secondary effluent and with raw sewage data from other cities. The composition of total and volatile solids was uniform throughout 1978; only the quantity changed. Saskatoon primary effluent contained 87% soluble solids, requiring maximum organic removal to be directed toward that fraction. Grease discharged from meat packing industries appears in the supra-colloidal fraction (83%). Grease removal after secondary treatment (using a rotating biological contractor) was about 88%. Distribution of organic nitrogen before and after primary treatment showed that nearly all removal occurred in the settleable and supra-colloidal fractions. Secondary treatment removed organic nitrogen from the supra-colloidal and soluble fractions. Overall removal of organic nitrogen was 74%. Phosphorus removal was accomplished during separation of the settleable fraction (22% of raw sewage). Secondary effluent contained 93% of the soluble phosphorus. BOD, COD, and total organic carbon studies produced inconclusive results. Copper and chromium were entirely within the settleable fraction. Zinc appeared in the supra-colloidal fraction and was not removed by primary or secondary treatment. (Cassar-FRC)
W81-01341

STATISTICAL COST FUNCTION DEVELOPED FOR SEWER LINES,
Johns Hopkins Univ., Baltimore, MD.
S. H. Hanke, and R. W. Wentworth.
Water and Sewage Works, Vol 127, No 12, p 55, December, 1980. 3 Ref.

Descriptors: *Construction costs, *Pipelines, Costs, Sewerage, Conveyance structures, Estimating, *Waste water lines, Cost analysis.

Since the average cost per unit of pipeline decreases as pipeline diameter increases, an equation has been developed to express this relationship for use in cost estimates for waste water lines. This formula relates total costs to pipeline diameter, flow rate, and several constants. For example, if pipeline capacity is increased by 100%, it is 95% certain that construction costs will increase by 36-39%. (Cassar-FRC)
W81-01342

CONTINUOUS MONITORING FOR SEWAGE-TREATMENT PURPOSES,
Severn-Trent Water Authority, Birmingham (England). Tame Div.
For primary bibliographic entry see Field 5A.
W81-01345

MODELLING THE DYNAMICS OF THE ACTIVATED SLUDGE WASTE WATER TREATMENT PROCESS IN TERMS OF THE CARBON VARIABLE,
Ugine-Kuhlmann, Pierre-Benite (France).
S. Perdrieux, and N. Therien.
Water Research, Vol 14, No 9, p 1333-1344, September, 1980. 16 Fig, 2 Tab, 19 Ref.

Descriptors: *Waste water treatment, *Activated sludge, *Mathematical models, Carbon, Organic compounds, Kinetics, Suspended solids, Biodegradation, Microorganisms, Biochemical oxygen demand, Sludge.

Carbon as a process variable was used to characterize the dynamic nature of the activated sludge process in terms of the soluble organic carbon for the substrate and the suspended solid organic carbon for the biomass. Intermediate carbon compounds stored in the cells were also considered in the mathematical models developed by the authors. This model utilized the concentration of organic substrate, the concentration of cellular material, and the concentration of products stocked in the cells for the aeration unit of the activated sludge process. The substrate and biomass concentrations predicted by this model are compared to simpler models based on the growth kinetic concept using Monod or two-phase expressions and to earlier work performed by the authors. The failure of the Monod model to predict some important aspects of the unsteady state operation is discussed. (McKeon-FRC)
W81-01347

THE ROLE OF THE COBALT CATALYST IN THE UNSTEADY-STATE TEST,
Simon-Hartley Ltd., Stoke-on Trent (England).
W. S. Robertson.
Water Pollution Control, Vol 79, No 4, p 487-495, November, 1980. 4 Fig, 1 Tab, 11 Ref.

Descriptors: *Aeration, *Unsteady state test, Cobalt, Copper, Dissolved oxygen analyzers, Oxygenation, Analytical techniques, Testing procedures, Equipment, Evaluation.

The unsteady-state test, used in testing aeration equipment, exhibits non-reproducible results. Preliminary comparisons with several methods of deoxygenation and dissolved oxygen measuring methods indicated that chemical interference was probably the cause of discrepancies. Tests with copper sulfite catalyst showed that it was suitable for the sulfite oxidation method, but not for the unsteady-state test. Tests with cobalt chloride showed the reverse situation. Chemical interference was absent at 5C, but more important at 15C and above. The cobalt catalyst appeared to be complexed and present as a precipitate, taking part in reactions and having a relatively high oxygen demand. However, its rate of reaction was slow and unpredictable, being affected by water composition and temperature. (Cassar-FRC)
W81-01357

UNUSUAL BEHAVIOUR OF CILIATED PROTOZOA IN A SECONDARY SETTLEMENT TANK,
Yorkshire Water Authority (England). Southwestern Div.
G. Wheale, and D. J. Williamson.
Water Pollution Control, Vol 79, No 4, p 496-500, November, 1980. 6 Fig, 4 Tab, 4 Ref.

Descriptors: *Activated sludge, *Protozoa, *Water pollution sources, Halifax(England), Effluents, *Waste water treatment, Sludge treatment.

During a period of high solids loading in the Halifax, Yorkshire, treatment plant, unusual white streaks (maximum size, 3 meters by 1 meter) were observed resting on the sludge blanket in a secondary settlement tank. This material was composed of large flocs about 1 mm diameter. Microscopic examination revealed that these flocs were spherical colonies of a peritrich similar to Carchesium polypinum. However, this species had faintly striated pellicles and clearly segmented stalks, different characteristics from those of Carchesium polypinum. Rotifers were also seen. Addition of a synthetic cationic polymer to assist settlement caused a release of flocculated colonies to the surface of the tank. The detached colonies may comprise a major proportion of the suspended solids in effluent from this plant. (Cassar-FRC)
W81-01358

ANAEROBIC CONTACT FILTER PROCESS: A SUITABLE METHOD FOR THE TREATMENT OF VEGETABLE TANNING EFFLUENTS,
National Environmental Engineering Research Inst., Kanpur (India). Zonal Lab.
H. C. Arora, and S. N. Chattopadhya.
Water Pollution Control, Vol 79, No 4, p 501-506, November, 1980. 2 Fig, 2 Tab, 3 Ref.

Descriptors: *Filtration, *Tannery wastes, *Anaerobic digestion, Industrial wastes, Chemical wastes, *Waste water treatment, Sludge digestion, Contact filter process.

An anaerobic contact filter process was further tested as a method of treating vegetable tanning effluents. Batch feeding simulated actual operating conditions in local tanneries. Retention periods varied from 12 hours to 144 hours. The influent was a mixture of liming liquor, exhaust tan liquor, and deliming liquor. In the initial stages there was

a progressive increase in precentage removal of COD to a maximum of 80-90%, which leveled off after 54 days (retention period 144 hours). However, when retention times were reduced to 48 hours on Filter I and 24 hours on Filter II, pollutant removal decreased initially, and gradually increased over a 2-week period to the 80-90% steady state. BOD and tanning levels behaved similarly. Subsequent reductions in retention time (to 24 hours for Filter I and 12 hours for Filter II) did not significantly affect removal of organic materials. Advantages over the conventional lagooning systems are smaller land area, smaller capital costs, no sludge disposal necessary, and production of a usable combustible gas. (Cassar-FRC)
W81-01359

THE USE OF ULTRA HIGH RATE DUAL-MEDIUM FILTRATION AND DISSOLVED-AIR FLOTATION FOR MAINTENANCE OF CONSISTENT EFFLUENT STANDARDS AT HIGH LOADINGS,
Water Pollution Research Lab., Stevenage (England).
P. H. Jago, J. A. Ovens, and P. E. Hale.
Water Pollution Control, Vol 79, No 4, p 442-451, November, 1980. 4 Fig, 3 Tab, 7 Ref.

Descriptors: *Filtration, *Flotation, Dissolved air flotation, Suspended solids, Waste water treatment, *Sewage treatment, Separation techniques.

Dissolved-air flotation and ultra high rate dual media filtration (sand, anthracite) are processes which can maintain effluent quality from secondary settlement tanks during periods of sudden increases in flow of sewage to the plant. These two pilot plant systems were operated in parallel from August, 1977, to June, 1978, at the Fengate sewage treatment works in a comparison study. The dissolved-air flotation process produced a final effluent containing not more than 30 mg per liter suspended solids from a secondary settlement tank effluent containing up to 550 ml per liter. The filter, unable to handle these high loads, could produce satisfactory effluent from influent levels up to 150 mg per liter at a flow of 6.5 mm per second and 200 mg per liter at 3.25 mm per second. The pilot plant filter required frequent backwashing, but remained clear of biological growth. (Cassar-FRC)
W81-01360

USE OF WATER HYACINTHS IN WASTE WATER TREATMENT,
Maryland Univ., Eastern Shore, Princess Anne.
G. C. Gupta.
Journal of Environmental Health, Vol 43, No 2, p 80-82, September/October, 1980. 30 Ref.

Descriptors: *Water hyacinth, *Waste water treatment, *Reviews, Publications, Coliforms, Sewage, Biochemical oxygen demand, Nitrogen, Phosphorus.

A literature review is presented on the use of water hyacinths in sewage and waste water treatment. Water hyacinths have been effective in removing algae, fecal coliforms, suspended particles, trace toxic metals, organics, and many other dissolved impurities from waste water. Water hyacinths are classified as an aquatic pest, but culturing hyacinths in a sewage lagoon system can reduce BOD5 up to 95%, total suspended solids up to 90%, and also reduce nitrogen, phosphorus, heavy metals, and pesticides. Biological, chemical, and physical factors combine to remove contamination. Five point one acres of water hyacinths are needed for 1 mgd throughput to remove 80% of the nitrogen and 44% of the phosphorus. Hyacinths are effective and cheap where land is available inexpensively. (Small-FRC)
W81-01361

TOWNSHIP OF TEMAGAMI: ONE ALTERNATIVE FOR SERVICING A NORTHERN COMMUNITY,
Ontario Ministry of the Environment, Toronto.
B. J. Cooper.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 140-149. 1 Tab, 3 Ref.

Descriptors: *Pressure sewers, *Ontario, *Cold regions, *Sewage disposal, Environmental sanitation, Sewage lagoons, *Sewage treatment, Sewers, Canada, Pipes, Public utilities, Cost analysis, Cost comparisons, Operating costs.

A low pressure, shallow buried, thermally insulated pressure sewer system was constructed to correct the serious environmental and public health problems at the Township of Temagami. Temagami, which is located approximately 460 km north of Toronto, has approximately 150 dwellings. The combination of 1300 freezing degree days Celsius and the location of the community on the Precambrian Shield resulted in very expensive servicing. Since most of the capital costs of construction were subsidized, the system with the cheapest operating cost per annum was used. The sewer system was composed of a styrofoam 'frost box' with the transmission main located in the box and buried only to a typical depth of 1.2 m. The final system involved 8,250 m of pipe, 30 valve chambers, a heat tracing system, 160 pumping units, and home service connections. A waste stabilization pond was constructed at a cost of approximately $304,000/ha and was designed for a 180 day retention period. From the pond, effluents are treated for phosphorus removal and then are discharged into the lake. Cost comparisons of this system and three more conventional systems are given along with a list of factors for consideration in the evaluation of pressure sewers versus gravity sewers. (See also W81-01381) (Seigler-IPA)
W81-01389

MODIFIED LOW PRESSURE COMMUNAL SEWAGE DISPOSAL SYSTEMS,
Sturgeon Health Unit, St. Albert (Alberta).
K. W. McAmmond.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 477-483. 3 Fig.

Descriptors: *Sewage disposal, *Alberta, *Sewage effluents, *Septic tanks, Sewage sludge, Sewage lagoons, Sanitary engineering, Liquid wastes, Rural areas, Sewage treatment, Environmental sanitation, Water pollution sources, Plastic pipes, Pumping.

A modified collection system using plastic pipe and a small lagoon is recommended as an alternative to present ineffective sewage disposal systems in Alberta. This modified low pressure communal sewage disposal system disposes of liquid effluent in a safe and reasonably economical manner for hamlets, suburban, and rural residential areas. The system uses septic tanks, automatically controlled sewage pumps, and plastic pipes. Raw sewage flows by gravity into a two compartment septic tank at each home where the liquid separates from the solid and the liquid flows into the second compartment. The liquid is then pumped through a plastic pipe into collector mains that convey the liquid to a lagoon located outside of the community. The sewage pumps are automatically activated by the liquid level in the septic tank. A checkvalve prevents backflow from the main. No problems with blockage or plugging have occurred where this system has been installed; the septic tanks are pumped out every second year. System benefits include protection from diseases, safe disposal of ground seepage water, increased real estate values, increased tax revenues through growth and higher assessments, safety for wells, and lowering of the water table that can eliminate the need for basement sump pumps. A recent cost estimate from the Hamlet of Busby, where there are 30 connections, is $110,900. (See also W81-01381) (Seigler-IPA)
W81-01409

THE TREATMENT OF WOOLSCOUR EFFLUENT - I. REMOVAL OF COLLOIDAL DIRT,
Department of Scientific and Industrial Research, Petone (New Zealand). Industrial Processing Div.
C. N. S. McLachlan, D. K. W. Smith, and R. J. Webb.
Water Research, Vol 14, No 7, p 729-733, July, 1980. 8 Fig, 2 Tab, 10 Ref.

Descriptors: *Wool grease, *Industrial waste, *Waste water treatment, *Flocculation, Polyelectrolyte, Flotation, Pilot plants, Centrifuge, Sludge, Sedimentation.

Removal efficiencies of colloidal dirt in woolscour effluent were studied using polymeric flocculants, dissolved-air flotation and sedimentation. The effectiveness of the polymers was tested in both laboratory and fullscale experiments. Results indicated that up to 80% of the dirt in the liquor was removed as a 20% weight to volume ratio solids sludge. This sludge was capable of further dewatering to 45-50% solids using a solid bowl centrifuge. There was no evidence of dirt re-deposition on the wool as a result of the use of the polyelectrolyte, nor was the use of the polyelectrolyte found to have a measurable effect on centrifugal grease recovery. A comparison of the results obtained using the settling tank and the flotation tank indicated that under normal circumstances a suitably designed settling tank provided the simplest method of solids removal when readily settlable solids and colloidal material were removed together. (McKeon-FRC)
W81-01413

THE TREATMENT OF WOOLSCOUR EFFLUENT-II. GREASE REMOVAL BY ALCOHOL EXTRACTION,
Department of Scientific and Industrial Research, Peton (New Zealand). Industrial Processing Div.
C. N. S. McLachlan, D. K. W. Smith, and R. B. Fieldes.
Water Research, Vol 14, No 7, p 735-740, July, 1980. 6 Fig, 5 Tab, 15 Ref.

Descriptors: *Solvent extraction, *Wool grease, Separation techniques, Industrial wastes, Waste water treatment, *Alcohols, Oily water, Flocculation, Polyelectrolytes, Biochemical oxygen demand, Pilot plant.

The use of pentanol in combination with a flocculant to crack a woolgrease-in-water emulsion and the subsequent separation and recovery of grease from the remaining colloidal dirt are described. The addition of 4-5% pentanol together with a synthetic polymer, Magnafloc 455, enabled a rapid separation of the de-emulsified grease and dirt from the liquor. The grease is then separated from the colloidal dirt, followed by steam stripping of the effluent streams to recover the pentanol. Grease removals from the liquor averaged 85-95% and BOD reductions averaged 50-75% in both laboratory and pilot scale trials. An effluent free of suspended solids and readily amenable to biological treatment was produced. (McKeon-FRC)
W81-01414

SEPARATING SOLIDS FROM LIQUIDS,
Courtaulds Ltd., London (England). (Assignee).
D. C. Woodward.
U.S. Patent No 4,197,180, 6 p, 4 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 993, No 2, p 616-617, April 8, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Water purification, Electrolysis, Electrodes, Carbon, Bubbles, Activated sludge, Equipment, Electroflotation.

In a process for the separation of solid particles from an aqueous liquid by electroflotation various effluent liquids can be clarified, surplus activated sludge can be concentration and protein can be recovered. The apparatus for carrying out the separation comprises a tank containing an anode and a cathode, at least one of these electrodes being formed from carbon fibres. The tank has an inlet for the aqueous liquid containing solid particles and an outlet for clarified liquid and means for removing solid particles which have been carried upwardly in the tank. The electrodes preferably comprise carbon fibres set in an electrically-insulating matrix and having exposed ends of carbon

fibres substantially throughout the length of the electrode. (Sinha-OEIS)
W81-01419

METHOD FOR MINIMIZING THE ORGANIC WASTES IN AQUEOUS PRODUCT STREAMS PRODUCED IN LIQUID-LIQUID EXTRACTION PROCESSES,
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). (Assignee).
W. Ochsenfeld, and J. Schon.
U.S. Patent No 4,197,195, 6 p, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 2, p 621, April 8, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Organic wastes, Absorption, Resins, Recycling, Distillation, Regenerating solvent, Regeneration.

A method is provided for minimizing the organic waste found in an aqueous process stream of products and refined products from a liquid-liquid extraction process. The aqueous process stream contains small quantities of interfering substances in the form of an organic extraction agent and decomposition products of the extraction agent and is treated with an agent which selectively, practically quantitatively and reversibly sorbs the interfering substances. This agent is a macroporous sorption resin based on polystyrene cross-linked with divinyl benzene. The sorption resin, after being charged with the interfering substances, is regenerated by being brought into contact with a regenerating solvent. The regenerating solvent is then separated from the sorption resin and subjected to a distillation. The distillate consists of pure solvent and is put back into circulation to regenerate sorption resin. The extraction agent obtained as the distillation residue is recirculated, after dilution with a dissolving diluent, and returned into circulation in the extraction process. (Sinha-OEIS)
W81-01420

SHIPBOARD BLACKWATER PHYSICAL/CHEMICAL TREATMENT SYSTEM,
Office of the Secretary of the (Navy). Washington, D.C. (Assignee).
C. S. Alig.
U.S. Patent No 4,197,200, 5 p, 1 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 622, April 8, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Water purification, Separation techniques, Disinfection, Ozone, Equipment, Incineration, Boats, Water supply, Shipboard systems.

An automatic dual-mode shipboard waste water treatment system employs ozone for disinfection of the primary effluent. Solids are removed and pumped to the ship's boiler or other equipment for incineration, while the liquid waste is pumped through a series of ozone reactors and then to a holding tank from which it is discharged overboard, after accumulating to a predetermined level. The system operates continuously by recirculating the effluent, during low flow periods, between a second holding tank and the ozone reactors. (Sinha-OEIS)
W81-01422

BIOLOGICAL SEWAGE TREATMENT PLANT,
Przedsiebiorstwo Instalacjiprzemyslowych, Katowice (Poland). (Assignee).
R. Przybylowicz, L. Narbutt, and J. Stepien.
U.S. Patent No 4,197,202, 7 p, 11 Fig, 17 Ref; Official Gazette of the United States Patent Office, Vol 993, No 2, p 623, April 8, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Sewage treatment, *Biological treatment, Equipment, Aeration, Flow, Absorption, Microorganisms, Oxygen.

A multi-stage biological sewage treatment plant includes a tank of cylindrical shape, divided concentrically by means of vertical annular stationary screens, forming chambers, and by means of movable annular screens forming sections performing various technological functions. Floats located in the walls of the movable screens ensure aeration of the liquid with gas. Regular aeration and mixing of the whole contents of liquid in the chambers ensure an optimication of hydraulic parameters and for maintaining the whole mass contained in the chamber in a state of suspension. This enables absorption of impurities contained in the sewage by the cell mass of microorganisms being the active sediment, whereas the factor stimulating the growth of microorganisms is the amount of oxygen fed by the aerating devices. (Sinha-OEIS)
W81-01423

WATER RECYCLING WITH SOLIDS AND FOAM REMOVAL,
The Water-Cyk Corp., Vienna, VA. (Assignee).
E. P. Toms.
U.S. Patent No 4,197,597, 9 p, 11 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 754, April 15, 1980.

Descriptors: *Patents, *Waste water treatment, *Domestic wastes, *Water reuse, Separation techniques, Filtration, Equipment, Hydraulics.

A water economizing system for new or existing buildings is described where the waste lines of lavatory sinks, showers and clothes washing machines are connected to a storage reservoir for the accumulation of the water. This accumulated water is filtered and treated and then used for the operation of water closets of toilets. The storage reservoir provides for the removal of solids and foam by flushing action at the top and subsequently for the gravitational separation of solids which are periodically flushed from the bottom of the reservoir into the sewer. The pumping action which delivers the accumulated water to the water closets of toilets may be hydraulically operated by a portion of the water drained to the storage reservoir. (Sinha-OEIS)
W81-01424

5E. Ultimate Disposal Of Wastes

DISPERSION AND WEATHERING OF CHEMICALLY TREATED CRUDE OILS ON THE OCEAN,
Chevron Oil Field Research Co., La Habra, CA.
C. D. McAuliffe, J. C. Johnson, S. H. Greene, G. P. Canevari, and T. D. Searl.
Environmental Science and Technology, Vol 14, No 12, p 1509-1518, December, 1980. 7 Fig, 5 Tab, 16 Ref.

Descriptors: *Dispersion, *Oil spills, *Water pollution control, Oily water, Surface waters, Oceans, Atlantic Ocean, Oil pollution, Oil wastes, Water pollution, Disasters, Water pollution sources, Control systems, Weathering, Emulsions.

Means to control oil spills were tested off New Jersey, at four experimental spills using Murban and La Rose crude oils. Immediately after the spill was made, two slicks were sprayed aerially with a self-mix dispersant from a pod and spray booms mounted above the skis of a helicopter. The other two slicks were sprayed similarly 2 hr after the spills were made. At 20-60 min after dispersion, the average total oil under the immediately treated slicks at 1, 3, 6, and 9 m were 0.7, 0.7, 0.3, and 0.2 mg/L for La Rose crude and 3.1, 2.4, 0.5, and 0.4 mg/L for Murban crude. At 20-45 min after treatment the highest concentrations were 3 mg/L for La Rose and 18 mg/L for Murban. In those spills treated 2 hr after spill the concentrations of oil were only slightly higher. Visual and photographic evidence indicated that Murban crude oil treated immediately was almost completely dispersed. For La Rose, immediate treatment resulted in about half the oil being immediately dispersed. Oil removed from the influence of wind by emulsification will not travel as far, and this will reduce the likelihood of oil stranding or entering biologically sensitive areas. Murban crude dispersion weathered more rapidly than La Rose, reflecting Murban's lower viscosity and perhaps its smaller droplet sizes. (Baker-FRC)
W81-01259

HANDLING HAZARDOUS WASTES,
Battelle-Columbus, OH.
J. A. Gurklis, and L. E. Vaaler.
Industrial Finishing, Vol 56, No 12, p 14-21, December, 1980. 1 Fig, 1 Tab, 4 Ref.

Descriptors: *Waste disposal, *Landfills, *Waste treatment, *Heavy metals, Sludge disposal, Industrial wastes, Sanitary engineering, Public health, Legal aspects, Costs, Waste water treatment, Sludge, Clean Air Act, Ultimate disposal, Potable water, Leaching, Monitoring, Incineration.

Under the Resource Conservation and Recovery Act (RCRA) of 1976 stringent regulations were imposed on the disposal of toxic wastes. The two types of wastes to be regulated under the RCRA were identified by their characteristics of ignitability, corrosivity, reactivity, and extraction procedure toxicity or by non-specific source listings. Waterborne and air emission wastes are regulated under the Clean Water Act, Clean Air Act and Safe Drinking Water Act. Chemical treatment is often employed for handling heavy metals, acids and alkalies, cyanide and other noxious gases. In the United States, the burden of waste treatment rests with the waste generator, while in Europe many government-owned facilities are operated for the treatment of hazardous wastes. After wastes are treated, ultimate disposal of wastes can take place at landfills or by incineration. Hazardous wastes landfills are engineered to avoid contamination of groundwater through leaching. Some landfills are covered with special liners, which are resistant to rodent and root penetration and which help contain toxic wastes. Leachate collection must be monitored, and other precautions are taken to secure the landfill. Centralized stations exist in Europe for the collection and disposal of paint wastes, oils and other toxic substances. Some costs of toxic waste treatment and disposal, as well as response of industry in attempting to recycle wastes and minimize this economic burden are discussed. (Geiger-FRC)
W81-01263

ANAEROBIC SLUDGE DIGESTION PROCESS WITH PROLONGED DIGESTION TIME FOR THE SOLID SUBSTANCES AND SHORTENED FOR THE SLUDGE LIQUOR,
Complex Research and Design Inst. for Communal Economy, Sofia (Bulgaria).
Ch. Dimovski.
Progress in Water Technology, Vol 12, No 3, 307-313, 1980. 1 Fig, 2 Ref.

Descriptors: *Anaerobic digestion, *Sludge treatment, *Wastewater treatment, Sludge digestion, Separation techniques, Settling basins, Aeration, Specifications.

A system for anaerobic sludge digestion which consists of a homogeneous digester and a sludge liquor separator was developed after laboratory and pilot studies. It works in a manner similar to an activated sludge system, as it utilizes aeration and settling tanks. The sludge is passed through the separator, and the solids are returned to the digester. Thus, the digestion time for the solids is lengthened. Since the liquor is separated quickly, its digestion time is shortened. The system is described, and formulas are provided for estimating technological parameters of the system, including: digester and separator capacities, average digestion time for solid substances and sludge liquor, quantity of discharged digested sludge and sludge liquor, and return sludge volume. The overall capacity of the system is 60-70% smaller than that of single stage digesters without sludge liquor separation, and 30-40% smaller than those of two-stage digesters. (Small-FRC)
W81-01306

DESIGN DATA FOR GRAVITY THICKENERS,
Water Pollution Lab., Stevenage (England).
M. J. D. White, C. F. Lockyear, and E. J. Tomlinson.
Progress in Water Technology, Vol 12, No 3, p

279-285, 1980. 5 Fig, 1 Tab, 1 Ref.

Descriptors: *Sludge treatment, Dewatering, Gravity, *Centrifugation, Analytical techniques, Estimating, Gravity thickeners, Thickenability, Design data.

A rapid test of thickenability was developed as method of characterizing sludge and as an aid in the design of full-scale thickeners. In this rapid test, a low-speed centrifuge is used to simulate the compressive effect of a deep sludge blanket. The compressibility of the sludge is determined by varying the centrifugal acceleration from 5 to 100 g. Thus, the effect of the blanket depth on the ultimate concentration of solids achievable in a full-scale thickener can be estimated. A built-in stroboscope is used to determine rate of thickening. Comparisons of predicted solids concentrations with those achieved in full-scale thickeners showed good agreement. The centrifuge predicted slightly higher concentrations, which can be explained by the fact that the sludge in the full-scale thickeners had not reached its ultimate solids concentration. (Small-FRC)
W81-01308

EVOLUTION OF PRIMARY SLUDGE DURING THICKENING,
Paris-6 Univ. (France). Lab. de Geodynamique.
F. Abosamra.
Progress in Water Technology, Vol 12, No 3, p 297-305, 1980. 15 Fig.

Descriptors: *Sludge treatment, *Fermentation, *Anaerobic bacteria, Microorganisms, Dewatering, Confined water, Compressibility.

Three types of sludge from waste water treatment plants were thickened for seven days in a gravity thickener. Intense fermentation took place the first day, and BOD, COD, ammonia, and volatile acids increased quickly. The bacteria and protozoa in the sludge form the substrate for anaerobic acidifying bacteria which use fresh sludge particles. The conjunction of the two substrates stimulates the development of the bacterial biomass. The fermentation changes the compressibility of the sludge because of the development of a thin layer of bacteria on the surface which retains free water. Thus, fermentation changes the filterability and dewaterability of the sludge. The lime-ferric chloride and polyelectrolyte demand of the sludges increased with fermentation. (Small-FRC)
W81-01309

COMPARATIVE INVESTIGATIONS OF DIFFERENT METHODS TO CONCENTRATE WASTE ACTIVATED SLUDGE,
Authority for Waste Water, Hanover (Germany, F.R.).
D. Kansy.
Progress in Water Technology, Vol 12, No 3, p 287-296, 1980. 6 Fig, 7 Tab, 8 Ref.

Descriptors: *Sludge treatment, Dewatering, *Separation techniques, *Activated sludge, Flotation, Gravity, On-site investigations, Evaluation, Gravity thickeners, Decanters, Dissolved air flotation.

Gravity thickening, dissolved air flotation, nozzle-type separators, and decanters were compared as methods to concentrate waste activated sludge. At the Hannover-Herrenhausen plant, the four methods were used in parallel for activated sludge with different sludge loading rates. Flotation or nozzle-type separation concentrated the sludge to 3-6%. Gravity thickening to 2.5-4% was possible with high loaded sludges only. Decanters concentrated to 8-15%. A good quality of clarified effluent (0.01-0.05%) was reached upon thickening by flotation, but effluent quality was poorer (0.10-0.20%) with nozzle-type separation. Decanters reached effluent values of 0.05-0.15% depending on the quality of the polymer used. Nozzle-type separation had the highest energy costs and the highest stress on the flocs. Centrifuges did not reduce the quality of the effluent. (Small-FRC)
W81-01310

LOW COST OF PROVISION OF ANAEROBIC DIGESTION,
Severn-Trent Water Authority, Birmingham (England).
G. P. Noone, and C. E. Brade.
Progress in Water Technology, Vol 12, No 3, p 315-329, 1980. 5 Fig, 2 Tab, 12 Ref.

Descriptors: *Anaerobic digestion, *Costs, Heating, Surveys, On-site tests, Design, Performance, Uprating, *Sewage sludge, Sludge treatment, Sludge disposal.

A survey was carried out to examine the significant variations in apparent design and operation of some existing Severn-Trent Water Authority digesters. These results, combined with literature information on pilot and full-scale plant operation, indicate that uprating of an existing plant should be the cheapest method of providing additional treatment capacity. When mixing and heating are adequate, there is increased reliability of digestion at a high rate. At the Sutton-in-Ashfield site, a digester of nominal volume 1373 cu m and conventional design was modified to provide a standby gas compressor. There has been an increase in solids loading and a reduction in detention time. At Shirebrook, one of three 400 cu m tanks was converted into a heated primary digester at a cost of $29,000. Although results are preliminary at Shirebrook, increased anaerobic digestion is possible by uprating existing plants, perhaps utilizing existing tanks. The new digestion plant should be on the basis of smaller volumetric provision of the primary reactor related to examination of the whole sludge flow sheet both prior to and post primary digestion. (Small-FRC)
W81-01312

USE OF MATHEMATICAL MODELS TO DERIVE A SYSTEM FOR CALCULATING THE ACCEPTANCE CAPACITY OF MARINE COASTAL WATERS. (UTILISATION DE MODELES MATHEMATIQUES DANS LA MISE AU POINT D'UNE METHODOLOGIE DE CALCUL DE LA CAPACITE D'ACCEPTATION DU MILIEU RECEPTEUR LITTORAL MARIN.),
Ingenieur General des Ponts et Chaussees, Grenoble (France).
M. de Rouville, G. Chevereau, and B. Quetin.
Progress in Water Technology, Vol 12, No 1, p 279-300, 1980. 6 Fig, 16 Ref.

Descriptors: *Methodology, *Diffusion, *Municipal wastes, Ocean currents, Oceans, Jets, Flow, Convection, Water pollution effects, Mediterranean, Mathematical models, Waste water disposal, *Sewage disposal.

A universal methodology is established to determine the dispersion of urban sewage discharged into marine coastal waters. Three separate programs are employed, which make it possible to simulate the essential phenomena of marine diffusion effluents: the changes in form of jets and plumes discharged in the presence of a thermal stratification, the latter being simulated based on meteorologic data; changes in effluent entrained by a surface current (convection, spreading, lateral and vertical diffusion), and bacterial autopurification. The use of this methodology in studies on the French Mediterranean is discussed, and case histories are presented. The model can be used to determine the effect of a particular discharge, and also to determine the capacity of the coastal waters to absorb polluting discharges. (Small-FRC)
W81-01321

MOVEMENT OF CHLORIDE IN A SOIL WITH VARIABLE CHARGE PROPERTIES: I. CHLORIDE SYSTEMS,
Sydney Univ. (Australia). Dept. of Soil Science.
K. Y. Chan, H. R. Geering, and B. G. Davey.
Journal of Environmental Quality, Vol 9, No 4, p 579-582, October/December, 1980. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Soil chemical properties, *Chlorides, *Leaching, Leachate, *Landfills, Hydrogen ion concentration, Adsorption, Movement, Model studies, Laboratory tests, Kinetics, Cation exchange, Neutralization, Anion adsorption, Ammonia, Path of pollutants.

Chloride solutions synthesized to simulate leachate of a treated sanitary landfill were run through columns filled with xanthic ferralsol subsoil in laboratory experiments designed to measure the movement of chloride. Chloride movement did not adhere to the miscible displacement equation or other more complicated models. The positive charge of the soil was more dependent upon pH and ionic strength of the leaching solution. When the alkaline synthetic leachate was poured through the column, the amount of positive charge was enhanced due to the greater ionic strength of the leachate relative to the soil solution. Smaller increases in positive charge were attributed to reductions in pH caused by cation exchange from the leachate front. As the alkaline leachate caused the soil pH to increase to over 9.0, the positive charge was neutralized by adsorption of hydroxide. These findings illustrate how the chloride outflow curve will deviate from theory under conditions where the positive charges of the soil are changed by the leachate solution. New kinetic models are needed to describe the alterations in the soil's charge properties induced by the solutions moving through it before more advanced theories of miscible displacement can be applied to this type of situation. (Geiger-FRC)
W81-01323

MOVEMENT OF CHLORIDE IN A SOIL WITH VARIABLE CHARGE PROPERTIES: II. SANITARY LANDFILL LEACHATE,
Sydney Univ. (Australia). Dept. of Soil Science.
K. Y. Chan, H. R. Geering, and B. G. Davey.
Journal of Environmental Quality, Vol 9, No 4, p 583-586, October/December, 1980. 3 Fig, 1 Tab, 13 Ref.

Descriptors: Movement, *Chloride, *Leachate, Anions, *Landfills, Waste disposal, Simulated rainfall, Soil chemical properties, Cations, Soils, Fluctuations, Ion transport, Leaching, Model studies, Hydrogen ion concentration.

The effects of a lime-treated sanitary landfill leachate on the movement of chloride through a column filled with the subsoil of a xanthic ferralsol were examined in laboratory tests. The displacement of the leachate solution in the column by distilled water was also studied to simulate the effects of rainfall upon the movement of chloride in the landfill soil. Deviations from the Nielsen-Biggar miscible displacement equation were observed when chloride movement was monitored. This was attributed to fluctuations in the level of positive charge carried by the soil caused by changes in ionic strength and pH. Analysis of the leachate showed the presence of carboxylate groups which competed with chloride anions for sites on the positively charged oxidic surfaces. Chloride was displaced at the end of the leachate treatment when distilled water was added, even though the pH was greater than 9. A net desorption of chloride of 0.69 milliequivalents/100 g was measured, showing that this anion cannot be ignored in models of salt solution movement through charged oxidic soils. (Geiger-FRC)
W81-01324

ENERGY CONSERVATION UNITS REPLACE OIL AT SOUTHERLY WASTE WATER TREATMENT CENTER,
Pirnie (Malcolm), Inc., White Plains, NY.
J. J. Stankunas.
Water and Sewage Works, Vol 127, No 11, p 26, 27, 56-58, November, 1980. 3 Fig, 5 Tab.

Descriptors: *Waste disposal, *Incineration, Ultimate disposal, Skimming, Cleveland, *Waste water treatment, Sewage treatment, Fuels, Disposal, Sludge disposal, Energy conservation.

Sewage skimmings (grease, oil, soap, vegetable matter), are burned as part of an energy conservation program at Cleveland's Southerly Waste Water Treatment Center. This procedure eliminates the disposal of skimmings and liquid wastes,

saving process and capital costs. Skimmings are collected, pumped to storage tanks, decanted, macerated, and heated in preparation for burning in combination with fuel oil. The skimmings-fired boiler at a steam capacity of 45,000 pounds per hour, operating 95% of the time, will produce 58% of the system's requirements and save 2.75 million gallons of fuel oil annually. The steam produced is used for sludge conditioning. Other energy conservation measures in this plant are heat pumps to transfer heat from effluent to provide heat for the 13 buildings (savings, 350,000 gallons of fuel oil annually) and energy wheels to recover heat in the building exhaust system during winter (10.3 gallons per hour savings). Heat obtained by incinerating sludge is used to make steam. Total energy savings in this project are 4.2 million gallons of No. 2 fuel oil annually. (Cassar-FRC)
W81-01336

FLUIDIZED-BED INCINERATION OF SEWAGE SLUDGE AT ESHER, 1976-1978,
Thames Water Authority, London (England). Southern Div.
R. Dickens, B. Wallis, and J. Arundel.
Water Pollution Control, Vol 79, No 4, p 431-441, November, 1980. 2 Fig, 4 Tab.

Descriptors: *Sludge treatment, *Incineration, Disposal, *Sludge disposal, Esher(England), Fluidized beds.

Experiences during 2-1/2 years of operating a sludge dewatering and incineration plant at Esher indicated that the fluidized-bed incinerator is reliable and easy to start up and shut down. Although this type of incinerator has a low manpower requirement, a skilled maintenance staff is necessary for efficient operation. The plant processes sludge from a city of 114,000 as well as sludge imported from neighboring communities. Sludge is dewatered in coil-filter vats, then incinerated in a reactor 9.98 meters high. This contains a fluidized, heated sand bed which breaks up sludge into small, quickly-combustible particles. Ash is removed from the effluent gas as a 3% slurry and settled in drying beds. Operational problems included corrosion of scrubber-recirculating pumps and ash transfer pumps by the ash slurry, repairs on sonic-spray equipment, decline in effluent quality, ash disposal, and noise complaints by residents. (Cassar-FRC)
W81-01344

THE DEVELOPMENT OF MARINE POLLUTION CONTROL IN HONG KONG,
D. W. Mackay.
Water Pollution Control, Vol 79, No 4, p 515-518, November, 1980. 1 Fig, 9 Ref.

Descriptors: *Hong Kong, *Municipal wastes, *Water pollution sources, Sea water, Sewage disposal, Sewage effluents, Industrial waste, Water pollution effects, Water pollution control, Planning.

The status of Hong Kong's waste discharges into Victoria Harbour, efforts at marine pollution control, effects on the aquatic environment, and future plans for pollution control are described. Total BOD wastes discharged into Hong Kong waters are about 140,000 tons per year. Domestic sewage generated by the 5 million inhabitants accounts for 65% of this total; agricultural wastes from 450,000 pigs and 5 million chickens, 15%; industrial effluents, 20%. About 750 tons per year of metals are discharged into the sea. Other problems are floating rubbish, oil pollution, and silt. About 90% of the population is served by the public sewer system. Thirty-six sewage treatment plants, including 17 secondary treatment plants, are in planning or construction. Seawater monitoring is conducted to provide data for planning. Some problems exist in the aquatic environment. In certain areas dissolved oxygen is low, nutrients and many metals are unacceptably high. Pathogens are monitored at the 37 regulated bathing beaches. Results are variable, but most record values less than 1,000 coliforms per 100 ml. Although marine pollution is not yet catastrophic, expansion of population, industry, and fish culture is expected to increase the pollution load by 50% within the next decade. An Environmental Protection Advisory Committee has been established to represent industrial and environmental groups in order to draft legislation and establish objectives for pollution control which will balance the interests of all parties. (Cassar-FRC)
W81-01349

EROSION BY CIRCULAR WALL JETS IN CROSS FLOW,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4D.
W81-01350

EFFECT OF NITRIFICATION ON MOVEMENT OF TRACE METALS IN SOIL COLUMNS,
California Univ., Davis. Dept. of Land, Air, and Water Resources.
F-H. Chang, and F. E. Broadbent.
Journal of Environmental Quality, Vol 9, No 4, p 587-592, October/December, 1980. 5 Fig, 7 Tab, 14 Ref.

Descriptors: *Nitrification, Metals, Movement, Denitrification, *Leaching, *Path of pollutants, Sewage sludge, Leachate, Soil chemical properties, Ammonia, Nitrogen compounds, *Soil tests, Hydrogen ion concentration, Sludge treatment, Nitrogen, Neutralization, *Heavy metals, Trace elements.

Sludge-treated and untreated samples of Omni silty clay and Delhi loamy sand were tested in soil column experiments to evaluate the effect of nitrification generated protons on the mobility of trace metals. Columns were leached two or three times per week with solutions of calcium chloride, ammonium chloride or potassium chloride, and the effluents after each leaching were analyzed for pH, inorganic N, percent 15N, and the metals Cd, Cr, Cu, Mn, Pb and Zn. After several months the columns were sectioned and the vertical distributions of hydrochloric acid-extractable metals were determined. All metals except Zn were present in effluents at average concentrations below 1 ppm. Ammonium chloride and potassium chloride leachings of Delhi loamy sand yielded effluents with Zn levels slightly above 1 ppm. Movement of Mn, Zn, Cu and Cd in untreated Delhi soil was influenced by nitrification. Sludge amended soil showed a stabilizing effect on Cd and Zn movement which was attributed to the formation of organo-metal complexes. Much of the input labeled NH4-N was denitrified, as indicated by N recoveries of 14-20% in the Omni soil and 40-78% in the Delhi soil. The generation of protons during nitrification was partially offset by neutralization during denitrification. It was concluded that metal mobility was affected very little by nitrification. (Geiger-FRC)
W81-01365

5F. Water Treatment and Quality Alteration

TREATMENT AND DISPOSAL OF SUGARBEET PROCESSING WASTE WATER BY IRRIGATION,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 3C.
W81-01220

CHLORINE RESISTANCE OF POLIOVIRUS ISOLANTS RECOVERED FROM DRINKING WATER,
Carborundum Co., Niagara Falls, NY. Electro Minerals Div.
P. T. B. Shaffer, T. G. Metcalf, and O. J. Sproul.
Applied and Environmental Microbiology, Vol 40, No 6, p 1115-1121, December, 1980. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Viruses, *Chlorination, *Water purification, Potable water, Water treatment, Public health, Standards, Resistance, Poliovirus.

Recent laboratory studies found that poliovirus 1, strain LSc, exhibited progressively greater resistance to inactivation by chlorine after exposure to sublethal doses of chlorine. This study tested poliovirus 1 isolates recovered from finished drinking water produced by a modern, well-operated water treatment plant, to see if they exhibited a similar increase in resistance to chlorine. The tested water contained free chlorine residuals in excess of 1 mg/liter. The chlorine inactivation of purified high-titer preparations of two such isolates was compared with the inactivation behavior of two stock strains of poliovirus 1, LSc and Mahoney. The surviving fraction of isolates was two orders of magnitude greater than that of the LSc and Mahoney strains. These studies suggest that a re-evaluation of the effectiveness of present disinfection practices as well as of the proposed chlorine-turbidity standard for drinking water may be necessary. Laboratory studies with stock virus strains may not always indicate what is actually going on in treated water. (Small-FRC)
W81-01248

LARGE-SCALE OZONE-DE FILTRATION: AN INDUSTRY FIRST,
Hazen and Sawyer, New York.
E. A. Bryant, and D. Brailey.
Journal of the American Water Works Association, Vol 72, No 11, Part 1, p 604-611, November, 1980. 4 Fig, 4 Tab, 3 Ref.

Descriptors: *Ozone, *Filtration, *Diatomaceous earth, Water purification, *Water treatment, *New York City, Croton system, Water quality, Potable water, Separation techniques, Costs, Environmental effects, Aesthetics, Alternate planning.

New York City chose the ozone-diatomaceous earth water treatment for improving water quality in its Croton system after comparisons with the high-rate conventional treatment and direct filtration with granular media. Considerations were effectiveness of treatments in meeting present and future standards, environmental impact, and costs. The ozonation-diatomaceous earth process produces water meeting all state standards, minimizes formation of chlorinated hydrocarbons, requires fewer but more highly skilled operators, deactivates bacteria and viruses prior to filtration, adjusts to rapid changes in quality of raw water, and needs less backwash water. The major reasons for the selection of the ozone-diatomaceous earth process are 30% less capital costs, compatibility with the environment, and adaptability to expansion to comply with future regulations. Disadvantages of the process are a lack of long-term experience on large scale units and the need for increased maintenance by a skilled staff. (Cassar-FRC)
W81-01288

CHLOROFORM PRODUCTION FROM THE CHLORINATION OF AQUATIC HUMIC MATERIAL: THE EFFECT OF MOLECULAR WEIGHT, ENVIRONMENT AND SEASON,
Canada Centre for Inland Waters, Burlington (Ontario).
B. G. Oliver, and S. A. Visser.
Water Research, Vol 14, No 8, p 1137-1141, August, 1980. 4 Fig, 3 Tab, 20 Ref.

Descriptors: *Water treatment, *Chlorination, *Humic acids, *Fulvic acids, Seasonal, Chloroform, Trihalomethanes, Rivers, Lakes, Organic compounds, Molecular structure.

Chloroform production from the chlorination of aquatic humic and fulvic acids that had been fractionated into eight molecular weight segments by ultrafiltration is discussed. Chloroform concentration per unit weight of humic material peaked at a molecular weight between 20,000-30,000 for the fulvic acids, and decreased with increasing molecular weight above 20,000-30,000 for the humic acids. Chlorination of samples from various aqueous environments (lake, river, stream, swamp, microbial) produced only minor fluctuations in chloroform concentrations. Chlorination of samples obtained from a single environment at different seasons of the year also produced similar chloroform concentrations. The authors conclude from their

sampling that the major chloroform precursors in aquatic humic material were the low molecular weight fraction (less than 30,000) of fulvic acids. The molecular weight and high surface activity of these fractions will make them difficult to remove by standard water treatment processes. (McKeon-FRC)
W81-01337

ST. LOUIS COUNTY STANDARDIZES PIPE AND PROCEDURES FOR RELIABILITY.
For primary bibliographic entry see Field 8G.
W81-01343

PROCEEDINGS -- SECOND SYMPOSIUM ON UTILITIES DELIVERY IN NORTHERN REGIONS.
Department of the Environment, Ottawa (Ontario).
Symposium held March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980. 550 p. Ottawa.

Descriptors: *Canada, *Conferences, *Public utilities, *Water delivery, *Cold regions, Water distribution(Applied), Waste disposal, Permafrost, Snow, Environmental sanitation, Sanitary engineering, Utilities, SCLAIRCOR, Building codes, Conference structures, Computer models, Pipelines.

The approaches, techniques, and materials suitable for northern utilities delivery systems were discussed in 30 technical presentations made at the conference. The papers cover eight topic areas: utility programs, energy considerations, technology applications, fire protection in the north, operation and maintenance, heat tracing and thawing, computer applications, and case studies. Factors that have contributed to the rapid development and improvement of northern systems include an improved understanding of thermal conditions through research, improved construction materials, emphasis on design and construction control, and better technology sharing and transfer. System reliability has been improved due to the efforts of those in charge of design, construction, and evaluation. (See W81-01382 thru W81-01411) (Seigler-IPA)
W81-01381

PROGRAMMING, DESIGN AND CONSTRUCTION OF UTILITIES IN GREENLAND,
Greenland Technical Organization, Copenhagen (Denmark).
G. P. Rosendahl.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 19-43. 19 Fig.

Descriptors: *Greenland, *Utilities, *Cold regions, *Sanitary engineering, Water supply, Water delivery, Sewage, Sewerage, Solid wastes, Ultimate disposal, Fire protection, Freezing, Public health, Surface waters.

The Greenland Technical Organization, established in the 1950's by the Danish Government, is responsible for all fields of technical development work in Greenland including water supplies, sewerage, refuse disposal, and fire protection. Greenland's water supply is based solely on surface water, and due to the varying topography, water supplies for most towns involve blast ditches, tunnels, gravity lines, and pump lines. Raw water lines are generally ductile cast iron pipes with electric heating cables. Water distribution is very expensive and most single-family housing areas are supplied by tank trucks, tank houses, or draw houses. Sewer lines are also very expensive and are intended for sewage only. All Greenland towns are situated on the sea so that sewage can be dumped directly without health or aesthetic drawbacks. Solid wastes removal and disposal is provided mainly by having established well-arranged hygienic conditions around disposal facilities including provisions for burning plastic/paper bags or cleaning buckets. Greenland's well organized fire protection system includes fire brigades, fire stations, an alarm system, water supplies, and instruction and training. (See also W81-01381) (Seigler-IPA)
W81-01383

A WATER SUPPLY SYSTEM FOR THE WORLD'S MOST NORTHERN PERMANENT COMMUNITY,
Department of National Defence, Westwin (Manitoba).
T. M. Y. Chong, and K. T. Mattes.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 367-393. 10 Fig, 1 Tab.

Descriptors: *Canada, *Cold regions, *Water distribution(Applied), *Water delivery, Plastic pipes, Freezing, Heat tracing, Insulation, Water treatment, Chlorination, *Pipelines, Water supply, Water conveyance, Water works, SCLAIRCOR.

The Canadian Forces Station Alert, located on the northern-tip of Ellesmere Island in the Northwest Territories, is installing a new water supply system that uses heat traced insulated pipe and sound engineering principles to virtually eliminate the possibility of freeze-ups. Alert's location 830 km from the North Pole makes it the world's most northerly permanent community. Design consideration for the new water supply system included reliability of service, fire flow and storage, method of construction, ease of operation and maintenance, early warning of problems, and energy conservation. Water is continuously pumped from the interior of heat traced insulated intakes by submersible pumps in Dumbell Lake. From the pumphouse the water enters a supply line made of heat traced insulated polyethylene pipe. At the water treatment plant the water is filtered, chlorinated, heated, and stored for pumping into the double loop distribution system. Due to costs, climate extremes, and a manpower shortage, the project has been divided into phases and, as of 1978, the new water supply line, treatment plant, and double loop distribution line were completed. Only one problem has occurred since the new water supply components were put into operation showing that severe climate conditions are no longer valid excuses for an inadequate water supply system. (See also W81-01381) (Seigler-IPA)
W81-01404

WATERWORKS SYSTEMS, YELLOWKNIFE, NORTHWEST TERRITORIES,
Reid, Crowther and Partners Ltd., Edmonton (Alberta).
J. R. Prentice, and G. A. Srouji.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 409-425. 1 Fig.

Descriptors: *Yellowknife(NWT), *Canada, *Water works, *Cold regions, *Water distribution(Applied), Freezing, Pipelines, Pumping, Pipes, Insulation, Heat tracing, Water supply, Water delivery, Water temperature, Pumping plants.

The City of Yellowknife, the most northerly major city in the western world, is taking steps to add to, and to modify its water system to meet the City's water demands up to the year 2001. The water system takes water from the Yellowknife River and pumps it through a submarine pipeline. A series of four pumphouses then pump the water to various areas such as the Giant and Con Mines, the central business district, the school, Forrest Park subdivision, the Mattonabee and Hospital districts, the Yellowknife Correctional Center, the mobile home park, and Frame Lake South. At least one more pumphouse/reservoir system will have to be installed for the Niven Lake subdivision. Each of the pumphouse units has its own distribution system with the key elements of the overall system being pumphouses 3, 4, and 1. As much of the system as possible is underground and methods taken to prevent freezing include heating the water prior to pumping, heat traced cables, and insulated pipes. Each subsystem has its own separate control and monitoring system. As the waterworks system continues to expand, existing relay systems in the 'old' pumphouses will be converted to programmable controller systems. An advantage of Yellowknife's planning was the discovery that heating requirements per liter of water in a given section of pipe have decreased over the years due to a build-up of lost heat. (See also W81-01381) (Seigler-IPA)
W81-01406

NEW APPROACHES TO WATER AND SEWER SERVICES IN PERMAFROST AREA -- NORMAN WELLS, N.W.T.,
M. M. Dillon Ltd., Edmonton(Alberta).
W. W. Irwin.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 507-542. 15 Fig, 1 Tab.

Descriptors: *Canada, *Cold regions, *Public utilities, *Water distribution(Applied), *Sewage treatment, Plastic pipes, Maceration, Sewers, Utilidors, Waste disposal, Conveyance structures, Sanitary engineering, Water delivery, Freezing.

From 1976 through 1978 the community of Norman Wells, located about 140 km south of the Arctic Circle, carried out a program of replacement and expansion of its water distribution and sewage collection services. Prior to improvements the community was serviced by a deteriorating utilidor system that was feeling the pressure for growth due to the then imminent Mackenzie Valley Pipeline. New system concepts were designed after geotechnical contraints were identified and basic material selections were completed. High density polyethylene and steel pipes were selected for buried services and ductile iron and steel for above ground services. Existing portions of the utilidor system were incorporated wherever practical. Essential elements of the water system are a single loop circulating distribution main, pretempering facilities and pumps houses in the existing booster pumping station, and a large heated storage reservoir. The sewage system has well-graded sewer lines and improved disposal facilities. All sewage is piped to a common outfall where maceration and submerged disposal facilities release the sewage well away from the shore. Performance of the system has been in general above expectations. Total cost for the water and sewage systems when completed will be in the order of $3.5 million. (See also W81-01381) (Seigler-IPA)
W81-01411

5G. Water Quality Control

STORMWATER MANAGEMENT TECHNOLOGY SYSTEMS DEMONSTRATION IN THE CITY OF ST. THOMAS.
MacLaren (James F.) Ltd., Toronto (Ontario).
Environment Canada, Canada Mortgage and Housing Corporation, Ottawa, Sewage Collection and Treatment (SCAT) Report 3, November, 1980. 212 p, 66 Fig, 26 Tab, 14 Ref, 7 Append.

Descriptors: *Storm runoff, *Water management(Applied), *Cost analysis, Technology, Urban drainage, *Water pollution soources, Computer models, *Urban runoff, Water pollution, Runoff forecasting, Canada, Storms, Storm water, Surface runoff, *Model studies, Simulation analysis, Mathematical models, Econometrics, Alternative costs, Planning, Biochemical oxygen demand, *St. Thomas(Ontario).

Advanced stormwater management techniques were used to determine cost-effective solutions to stormwater flooding and pollution problems in the City of St. Thomas. The development, use, and advantages of these techniques were reviewed, and a generalized methodology for their application to stormwater problems in other municipalities has been provided. Computer analysis and modeling techniques were used to evaluate solutions to three aspects of the drainage problem in St. Thomas: flood relief, and dry weather and wet weather pollution abatement. Dry weather problems were caused mainly by very low flow rates in the re-

ceiving water; combined sewer overflows and treatment plant by-passes were the major sources of pollution during wet weather. A priority-ranked total management program was designed for the city, composed of three cost-effective measures: (1) improved efficiency and increased frequency of street sweeping to reduce wet weather BOD loading to Kettle Creek; (2) effluent pipeline construction to Lake Erie to eliminate all dry weather effluent loadings to Kettle Creek; and (3) completion of sewer separation in combined sewer areas to eliminate basement flooding and combined sewer overflows. Estimated BOD reductions were 25, 44, and 25% for these three measures, respectively. (Zielinski-IPA)
W81-01211

WATER BANK PROGRAM, 1972 THROUGH SEPTEMBER 30, 1979.
Agricultural Stabilization and Conservation Service, Washington, DC. Management Services Div.
Report, February, 1980. 10 p, 4 Tab.

Descriptors: *Wildlife habitats, *Habitat improvement, *Wetlands, *Water control, Migratory birds, Waterfowl, North Dakota, South Dakota, Minnesota, Wildlife conservation, Conservation, Potholes, Erosion, *Water Bank Program.

Under the Water Bank Program, the Secretary of Agriculture is authorized to enter into 10-year agreements with landowners and operators in improtant migratory waterfowl nesting and breeding areas to preserve, restore and improve the nation's wetlands. The area placed under the program is designed to preserve and improve habitat for migratory waterfowl and other wildlife resources, to reduce runoff and soil and wind erosion, and to contribute to water control. The program is being concentrated in the pothole wetland areas of the Central and Mississippi flyways with a limited number of counties in other wetland areas of the country. From 1972 through 30 September 1979, 5,227 agreements have been carried out under the program involving a total of 590,367 acres. Of this, 162,296 acres are wetlands and 428,071 acres are adjacent areas. North Dakota, South Dakota and Minnesota had the greatest number of agreements. Payments under the program have amounted to $7,094,784. (Moore-SRC)
W81-01229

TEMPORARY PIPELINE AVERTS WATER QUALITY EMERGENCY.
Public Works, Vol 111, No 12, p 40-41, December, 1980. 1 Fig.

Descriptors: *Pipelines, *Farm wastes, Water pollution, Reservoirs, Water quality, Public health, Pumping, Watersheds, Water pollution sources, *Water pollution control, Hogs.

When the impounding reservoir of the Farnham, Quebec water system became polluted by a hog farm in the watershed, the Farnham treatment plant had to take rapid emergency measures to protect the public from developing skin rashes and other health problems associated with use of the contaminated water supply. Under the approval of local and provincial officials, plant authorities contracted with the Williamstown Irrigation Corporation to lay a temporary pipeline to feed the treatment facility with water supplies upstream of the reservoir and the source of pollution. The pipeline took only days to lay, and with the aid of pumps, plant capacity was brought up to the expected load of 3.6 mgd. The Tico brand pipe which was used for the emergency situation in Farnham is stocked by the Williamstown company in 30 foot lengths to supply up to 2 miles of pipeline in unexpected situations. The company has the ability to fabricate more pipeline in a short period of time when needed. The pipe was laid along the path of a railroad bed and spanned a transmission route of about 2.5 miles. (Geiger-FRC)
W81-01284

INDEX TO EVALUATE LAKE RESTORATION,
Tetra Tech, Inc., Lafayette, CA.
D. B. Porcella, S. A. Peterson, and D. P. Larsen.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE6, p 1151-1169, December, 1980.

Descriptors: *Lakes, *Water quality control, *Mathematical studies, Water quality, Model studies, Water pollution control, Limnology, Federal Water Pollution Control Act, Phosphorus, Dissolved oxygen, Nitrogen, Chlorophyll, Turbidity, Eutrophication, Aquatic plants, Aquatic algae, *Lake restoration, Evaluation.

In an ongoing project to devise methods of restoring polluted lakes and preventing the contamination of clean lakes, target variables of water quality were analyzed independently and in combinations to arrive at a Lake Evaluation Index (LEI) to facilitate comparisons of water quality of various bodies of water. The LEI was used to express the overall change in water quality that might occur as a result of restoration process. It was hoped that the LEI would allow more precise evaluations of the efficiencies of various treatment procedures on a wide variety of lakes. Some of the limnological parameters included in the LEI are total phosphorus, total nitrogen, chlorophyll, Secchi depth, dissolved oxygen, and macrophyte coverage. Lake managers using the new index will be able to monitor shifts in the LEI numbers to readily assess changes in water quality. When the LEI system was applied to two restored lakes, results showed that the index was responsive to restoration efforts that actually produced changes in lake quality. When the water improvement effects of some restoration procedures were delayed, the LEI also reflected this time lag in response. (Geiger-FRC)
W81-01296

METHOD FOR REMOVING OIL FILM FROM WATER SURFACE,
T. V. Abaeva, N. M. Antonova, J. K. Lukmanov, O. S. Mochalova, and I. A. Nemirovskaya.
U.S. Patent No 4,197,197, 4 p, 5 Ref; Official Gazette of the United States Patent Office, Vol 993, No 2, p 621, April 8, 1980.

Descriptors: *Patents, *Water quality control, *Water pollution treatment, *Oil pollution, Dispersants, Surfactants, Biodegradation, Chemical reactions, Petroleum.

The invention relates to a dispersant for removing petroleum and petroleum products from the surface of water basins. The dispersant comprises an aqueous solution of a surfactant, viz. a mixture of salts of phosphoric acid esters and hydroxyethylated higher aliphatic alcohols. The dispersant is a non-toxic biologically degradable compound which enables its use for the removal of petroleum and petroleum products not only from the sea surface but also from the surface of shallow and small-size closed water basins. (Sinha-OEIS)
W81-01421

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

METHODS FOR DERIVING OPTIMAL OPERATING RULES FOR MULTIPLE RESERVOIR SYSTEMS,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
L. E. Johnson, D. P. Loucks, and J. R. Stedinger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156671, Price codes: A06 in paper copy, A01 in microfiche. Project Completion Report, December, 1980. 97 p, 37 Fig, 2 Tab, 44 Ref, 2 Append. OWRT-A-088-NY(1), 14-34-0001-0134.

Descriptors: *Reservoir operation, *Optimization, *Planning, Simulation analyses, Systems analysis, Competing uses, Linear programming, *Model studies, *Multiple-purpose reservoirs.

Using both optimzation and simulation models in an interactive manner through the use of computer graphics, an approach is discussed for defining multiple reservoir operating policies. These policies are specified in a form familiar to reservoir operators, namely zones of reservoir storage that may vary in magnitude throughout the year and which denote water to be allocated to specific uses downstream. The optimization models used to define these zones also provide estimates of the reliabilities of meeting various downstream demands from each of the storage zones. Flood storage is also considered, and all zones are simulated to further improve and evaluate the effectiveness of the multiple reservoir operating policies. Flood storage is also considered. The operation of multi-reservoir operating policies based on flood and conservation storage zones are simulated to further improve and evaluate the effectiveness of the multiple reservoir operating policies.
W81-01204

QUENCHING THE THIRST FOR POTABLE WATER IN ARID SAUDI ARABIA,
American Water Works Association Research Foundation, Denver, CO.
J. F. Manwaring, R. G. Lee, and J. W. Hoffbuhr.
Journal of the American Water Works Association, Vol 72, No 12, p 656-665, December, 1980. 8 Fig, 1 Tab.

Descriptors: *Water supply, *Saudi Arabia, Water shortage, Reverse osmosis, Water treatment, Water resources, Water quality control, Potable water, Water resources development, Arid lands.

The drinking water conditions in terms of quality and facilities in rural areas of Saudi Arabia were investigated along with the existing operation and maintenance programs used by the water systems and the regulatory control exercised over these systems. The poor water conditions prevalent in the rural municipalities result from environmental conditions limiting the availability of high quality source water, the explosive growth that is placing new and heavy demands on municipal water supplies, the lack of treatment facilities, and the absence of proper operating and maintenance procedures. On the other hand, the country has an extremely advanced reverse osmosis plant near the capital, emphasizing the vast contrasts in this country, which present additional problems. The lack of significant rainfall places the demand far in excess of the supply. Existing rural water supply facilities, consisting of wells, treatment plants and distribution systems, and storage facilities must advance as the country becomes more industrialized. Improvements are needed in the areas of water system information, training of personnel, monitoring, preventive maintenance, inventory, and record keeping. A practical and cost-effective approach to rectify the problems is presented. (Baker-FRC)
W81-01287

WHICH PLANT EXPANSION IS THE MOST URGENT ONE IN A RIVER SYSTEM AND HOW TO DEVELOP A PRIORITY LIST,
Ruhrverband, Essen (Germany, F.R.).
K. R. Imhoff.
Progress in Water Technology, Vol 12, No 3, p 119-122, 1980. 1 Tab, 4 Ref.

Descriptors: *Equations, *Water quality, *Feasibility, *Project planning, Effluents, Biochemical oxygen demand, Rivers, Chemical oxygen demand, Priorities, *Waste water treatment, Europe.

Three mathematical expressions are formulated and then combined to evaluate the quality of receiving water, the waste water discharge, and the feasibility of plant expansion. Effluent quality equals the average COD or BOD concentration of the effluent in dry weather in mg/liter divided by the goal or standard COD or BOD in mg/liter. Receiving water quality is calculated below the proposed discharge point at low flow and is equal to the COD or BOD at low flow in mg/liter divided by the goal or standard COD, also in mg/liter. Feasibility is calculated by relating additional load reduction to additional cost. The related additional load reduction of the specific project being considered is divided by the corresponding load to

cost ratio of a reference plant. The priority of a project can be defined as the product of the feasibility, effluent quality, and receiving water quality. (Small-FRC)
W81-01320

ANALYSIS OF PREVENTIVE SEWER MAINTENANCE PROGRAMS,
J. E. Liebeskind.
Public Works, Vol 111, No 12, p 45-48, 76, 77, December, 1980. 2 Tab.

Descriptors: *Sewers, *Repairing, *Water resources planning, Economic efficiency, Management, Coordination, Maintenance, Administration, Estimated costs, Forecasting, Budgeting, Census.

Elements of successful preventive sewer maintenance programs are identified, based on a study of six exemplary programs. Preventive maintenance programs insure the integrity of the collection system as planned, designed and constructed, and produce long-term cost savings. Effective management is the cornerstone of sewer maintenance. This includes collection of accurate records, analysis of trends, accounting, and detailed sewer mapping. Services should be provided by contract when cost-effective or when special skills are required. Surveillance, inspection, and monitoring activities provide information necessary to develop and plan operation and maintenance programs. Techniques include lamping, photography, weirs, metering, smoke testing, dye testing, and surface indicators such as depressions. The study indicates that sewer districts of all sizes can incorporate elements cited here in preventive maintenance programs. (Titus-FRC)
W81-01322

WATER QUALITY AND HUMAN ACTIVITIES: A MONITORING AND MODELING EFFORT IN FINLAND,
National Water Board of Finland, Helsinki.
For primary bibliographic entry see Field 6B.
W81-01326

DEVELOPMENT OF IMPROVED WATER MANAGEMENT PRACTICES IN PAKISTAN,
Colorado State Univ., Fort Collins. Engineering Research Center.
G. V. Skogerboe, W. D. Kemper, and J. O. Reuss.
Water Supply and Management, Vol 4, No 5/6, p 299-312, 1980. 1 Fig, 26 Ref.

Descriptors: *Pakistan, *Irrigation canals, *Water management, Agricultural engineering, Water conveyance, Organizations, Training, Farm management, *Water resources development.

Since 1976 an On Farm Water Management Pilot Project has been underway in Pakistan. This work involves imprrovement of 1,500 of the country's 80,000 watercourses to reduce water losses through cleaning and lining channels, precision land leveling, and improvement of agronomic and irrigation practices. Institutional objectives of this project comprise development of a core of water management advisors, engineers, and agriculturists; a permanent research program; farmer education; a network of water users' associations, and a private enterprise for manufacturing and marketing water management equipment. The University of Agriculture at Faisalabad agreed to provide training for advisory personnel in a 4 and 1/2 month course which is 75% field work and 25% classroom work. The project will continue with a detailed evaluation of a sampling of watercourses by field examination and personal interview. After 2 and 1/2 years of activity the target number of watercourses had not been investigated. However, the farmers were highly receptive to the field teams. Training programs are producing increasing numbers of field personnel. (Cassar-FRC)
W81-01328

INPUT-OUTPUT MODELING FOR FACILITY LEVEL WATER PLANNING,
Catania Univ. (Italy). Ist. di Idraulica Idrologia Gestione Acque.
B. M. Reitano, and D. W. Hendricks.
Water Supply and Management, Vol 4, No 5/6, p 379-396, 1980. 10 Fig, 2 Tab, 8 Ref.

Descriptors: *Input-output analysis, *Systems analysis, *Planning, Cache La Poudre River Basin(CO), Model studies, River basins, Colorado, *Water resources development.

An input-output water transaction table for the highly complex Cache La Poudre, Colorado, water system required 1 man-year for development. Using a matrix format, it has 123 components and shows 400 water transactions. The construction of an input-output model is described, using the Cache La Poudre system as an example. This model has 9 categories (entries, exits, reservoirs, ditches, industries, etc.) with a total of 109 components (specific waterways, treatment plants, etc.). The time factor is represented by both time increment and calendar position. Line diagrams are used to define connections between components. 109 mass balance diagrams and explanatory notes provide the data base. This time-saving model presents the water system in a form easily understood by persons unfamiliar with the system. (Cassar-FRC)
W81-01331

A SYSTEMS APPROACH TO THE STUDY OF INTERBASIN WATER TRANSFERS: THE PARTIAL DIVERSION OF THE USSR'S NORTHERN RIVERS FLOW INTO THE VOLGA,
Soyuzgiprovodkhoz, Moscow (USSR).
N. N. Moiseev, A. S. Berezner, F. I. Ereshko, and A. V. Lotov.
Water Supply and Management, Vol 4, No 5/6, p 323-337, 1980. 2 Fig, 6 Ref.

Descriptors: *Systems analysis, *River basin development, *Inter-basin transfer, Water transfer, *Russia, Optimum development plans, Caspian Sea, Azov Sea, Transportation, Fisheries, Volga River basin, Irrigation, Agriculture, Forecasting, Planning.

A systems analysis approach to solve the problems of supplying water to southeastern European Russia is discussed. The problem is to be solved by diverting some of the runoff from northern rivers to the Volga Basin. Objectives are described in a hierarchal system, that is, certain lower level objectives must be solved before answers to the higher levels may be found. First level problems concern overall social development (examples, increases in population's living standard). The second level relates to rational use of water resources (protection of environment). The third and fourth levels concern water supply activities (examples, pollution treatment, desalinization, rainfall stimulation). Several conclusions were reached by analysis of combinations of alternatives from various groups. The Ob River should not be diverted because costs would be too high. Cessation of new irrigation activities will not solve the problems of the Caspian Sea. Present irrigation growth rates should be continued into the future. New methods of irrigation (drop, mist, subsurface) should grow at a rate not greater than 2-3% because of high capital costs. Reduction of the level of the Caspian Sea is not desirable. Restoration of fisheries in the Azov Sea can be accomplished by a dam in the Straits of Kerch. Priority should be given to hydroelectric power generation at the Volga-Kama facilities. Water transportation depth should initially remain at the standard level and later be increased. Water transfers should include 35-40 cubic km of water per year from Lake Onega and adjoining rivers. Minimal disturbances would result if water were drawn from a reservoir to be built on the Onega River estuary. These alternatives will meet the water requirements of European USSR into the distant future. (Cassar-FRC)
W81-01335

STOCHASTIC GENERATION OF ANNUAL STREAMFLOWS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
R. Srikanthan, and T. A. McMahon.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY12, p 2011-2028, December, 1980. 5 Tab, 20 Ref.

Descriptors: *Mathematical models, *Streamflow, *Australia, Flow measurement, Annual, Reviews, Natural streams, Correlation analysis, Theoretical analysis, Variability, Streamflow forecasting, Monte Carlo method.

At present, several models exist for the generation of streamflow that are useful in planning water resources development. Some short memory models such as the Markov and ARIMA, which are autoregressive models, belong to the short memory group. Fractional Gaussian noise and broken line systems belong to the long memory models. These models and some variations on them were applied to a set of Australian streams, and an operational comparison was made. The ARIMA model was shown in a series of Monte Carlo simulations to be capable of producing data from which the lag one autocorrelation and Hurst coefficients could be estimated from the streamflow series. The ARMA model with a Box-Cox transformation, the ARMA-Markov model, and the white-Markov model did not successfully preserve the autocorrelation, while the other models examined preserved all the input parameters. Short memory models preserved the Hurst coefficient to a greater extent than the long memory models when the value of the coefficient was less than or equal to 0.65. None of the systems examined preserved the Joseph effect in the sequences generated, especially in the case of highly variable streams. (Geiger-FRC)
W81-01369

RURAL SCHOOLS PROTOTYPE ANALYSIS,
Construction Systems Management, Inc., Anchorage, AK.
T. W. Livingston, and N. Kjeistad.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 439-474. 9 Fig.

Descriptors: *Alaska, *Cold regions, *Schools(Education), *Facilities, Design criteria, Water supply, Design standards, Construction, Buildings, Specifications, Design data, Building codes, Environmental engineering, Secondary schools, Rural areas, Community development, Public utilities.

A resource guide was developed to aid designers, school district personnel, and State administrators in the planning and construction of the many Alaskan rural secondary schools to be built in the next few years. No overall, universally desirable design is possible as schools may range from 23 students with 2 teachers to 800 students with 30 teachers. The guide has three volumes, Volume I, Design Determinants and Options; Volume II, Methodology; and Volume III, Field Data. Alaska bush schools are not simple buildings with classrooms as in normal urban areas, rather they must be a self-sufficient community facility that operates and maintains its own utility system, in addition to providing an education program. Design determinants must consider building program determinants, environmental determinants, and site utilities determinants. Four enrollment sizes were used to provide rural schools prototype analysis. The guide provides checklists for identifying various design determinants. An example of the use of the guide is given using the design of a secondary school for the fictitious village of Kuchpu, Alaska. Facility sections and floorplans are used to illustrate school designs. (See also W81-01381) (Seigler-IPA)
W81-01408

WATER AND SEWER UTILITIES FOR BARROW, ALASKA,
CH2M/Hill, Anchorage, AK.
L. D. Leman.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 484-506. 7 Fig.

Group 6A—Techniques Of Planning

Descriptors: *Alaska, *Utilities, *Utilidors, *Cold regions, *Urbanization, Utiliducts, Planning, Water works, Water distribution(Applied), Community development, City planning, Sewers, Underground structures, Conveyance structures, Electrical service, Television, Telephone lines.

A detailed analysis of the utility needs and constaints of Barrow, Alaska, has lead to the recommendation of a combination of above- and below-ground utilidors to best meet the community's requirements. In the central core area, where traffic and existing structures make convenience and aesthetics important, below-ground utilidors are recommended. In areas such as Browerville, where cost is the controlling factor, above-ground portions are recommended. The study was based on the premise that a coordinated utility system can best be provided through construction of large insulated utility conduits (utilidors) to carry primary distribution and collection pipes and wire throughout the community. Smaller conduits (utiliducts) will connect the service to houses and other buildings. The utilidors will also have space for telephone, television, and electrical service lines in addition to sewer and water lines. Utilidors should be constructed of steel, ductile iron, or wood staves. Pipes should be copper, high molecular weight polyethylene, or galvanized iron. A capital cost of $52 million is estimated for the system with a monthly operating and maintenance cost per unit of $168. Final design is still pending and because the estimated $52 million project cost is beyond normal funding levels for such projects, special dispensations from several agencies may be required. (See also W81-01381) (Seigler-IPA)
W81-01410

6B. Evaluation Process

AN EMPIRICAL APPLICATION OF A MODEL FOR ESTIMATING THE RECREATION VALUE OF INSTREAM FLOW,
Colorado State Univ., Fort Collins. Dept. of Economics.
R. G. Walsh, R. K. Ericson, D. J. Arosteguy, and M. P. Hansen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156614, Price codes: A05 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report No 101, October, 1980. 66 p, 7 Fig, 11 Tab, 63 Ref. OWRT-A-036-COLO(2), 14-34-0001-8006.

Descriptors: *Model studies, Estimating, *Recreation demand, *Use rates, *Water sports, Fishing, *Cost-benefit analysis, Experimental models, Research and development, Synthesis, Testing, Reasonable use, Water utilization, Water allocation(Policy), Benefits, Public benefits, Fringe benefits, Riverflow, Streams, Public access, *Rocky Mountains(CO), Colorado.

Public benefits from cold water river fishing, kayaking and rafting on the West Slope of the Colorado Rocky Mountains were assessed during the summer of 1978 using a representative sample of 206 persons interviewed at nine river sites. Willingness to pay was found to be contingent on changes in congestion and water level. Recreation benefit functions were related to several important variables, including instream flow, crowding, characteristics of participants, and management costs. Policy implications were discussed with emphasis on application of the information to water management decisions. The contingent valuation approach proved successful for valuing the public benefits for this study area. The technique appeared appropriate for valuation of a wide variety of nonmarket goods, including the effects of congestion and instream flow. Expanding fishing opportunities would provide benefits to individuals having access to western rivers due to the result of less congestion at substitute sites. Providing optimum access to 15% more miles of river would increase western fishing benefits by an average of $1.25 per user-day. Marginal analysis found maximum total benefits for kayaking/rafting during spring/early summer; but for boating/fishing, from late July through September. (Zielinski-IPA)
W81-01210

EFFECTS OF NATURAL GAS PRICE INCREASES ON TEXAS HIGH PLAINS IRRIGATION, 1976-2025,
Winrock International Livestock Research and Training Center, Morrilton, AR.
K. B. Young, and J. M. Coomer.
Department of Agriculture, Economics, Statistics, and Cooperatives Service, Agricultural Economic Report No 448, February, 1980. 35 p, 3 Fig, 14 Tab, 24 Ref, 1 Append.

Descriptors: *Natural gas, *Irrigation, *Grains(Crops), *Cotton, *Prices, *Texas, Farm prices, Economics, Sorghum, Wheat, Dry farming, Projections, Pumping, Operating costs, High plains(TX).

Irrigation pumping costs, irrigated acreage, cropping patterns, and annual net farm income were projected for the period 1976-2025 in a 32-county region of the Texas High Plains. Alternative price scenarios for major grain crops and natural gas were used in the projections. Grain sorghum and cotton output projections, based on a constant gas price and intermediate-level grain prices, showed a decline of 61 and 33%, respectively. Wheat output from increased dryland production rose 23%. Similarly, the rising natural gas price and intermediate-level commodity prices produced a wheat output increase of 44%, a grain sorghum decrease of 70%, and a cotton decrease of 33%. Irrigation-pumpage, when a constant natural gas price was used, declined from 5 million acre-feet in 1976 to less than 1.2 million in 2025, and estimated annual net crop income declined from $277 million to $185.5 million. Irrigation of major crops when an increasing natural gas price was used was projected to terminate in 1995, and annual net crop income to decline from $277 million to $164 million. Use of high-level grain prices as a base resulted in more intensive irrigation development for 1976 to 1990, but irrigation termination was still projected to occur at approximately the same date, 1995. The price of natural gas was the primary factor affecting the economic life of irrigation in this analysis. (Author's abstract)
W81-01222

AN EVALUATION OF 'A PROCEDURE FOR DESCRIBING FISH AND WILDLIFE IN PENNSYLVANIA'.
Fish and Wildlife Service, Kearneysville, WV. Eastern Energy and Land Use Team.
Task Force Report FWS/OBS-79/19-A, September, 1980. 18 p, 2 Tab.

Descriptors: *Methodology, Wildlife, *Data collections, Standards, *Ecological Distributions, *Pennsylvania, Fish, Costs, *Wildlife habitats, Distribution, Wildlife management, Information exchange, Legal aspects.

A proposed methodology for summarizing fish and wildlife species distribution and habitat data was evaluated by EELUT and outside reviewers to assess its scientific and technical acceptability and usefulness. The procedure was found to be within legal constraints and cost-effective. Ninety-one percent of all reviewers thought the procedure was an accurate, comprehensive, and useful standard method for describing fish and wildlife species; 91% also thought an information system would be useful for regulatory programs, preparing and reviewing impact assessments and statements, planning and coordination activities, land and water management programs, resource inventory and assessment, land acquisition, research, and information transfer. Data compiled using the procedure in Pennsylvania was examined and found to be 95% consistent with the coding instructions and 88% accurate, when compared to the reference sources. The species list for the Pennsylvania data base was found to be more comprehensive than other sources of species lists and compared well with other specialized lists. (Moore-SRC)
W81-01231

ECONOMICAL CONSIDERATIONS ON LOCAL OR CENTRALIZED WASTE WATER TREATMENT SYSTEMS,
Ruhrverband, Essen (Germany, F.R.).
G. W. Annen.
Progress in Water Technology, Vol 12, No 3, p 123-217, 1980. 4 Fig, 1 Tab.

Descriptors: *Construction costs, *Project planning, *Operating costs, Economic efficiency, *Waste water treatment, Cost analysis, Treatment facilities, Europe, Federal Republic of Germany.

Because of the tendency of operating costs to continue to increase a centralized waste water treatment facility may have advantages over decentralized systems. The construction costs of a centralized system are higher, but when the operating costs are considered, centralized sewage treatment is the most economical solution. Data on over 100 biological treatment plants of the Ruhrverband are discussed, and the exponential regression of both construction cost and operating cost with increasing population is presented. The discount method is used to give one figure for both construction and operating costs. The causes of increasing operating costs are not discussed fully, but inflation is mentioned as a factor. (Small-FRC)
W81-01319

WATER QUALITY AND HUMAN ACTIVITIES: A MONITORING AND MODELING EFFORT IN FINLAND,
National Water Board of Finland, Helsinki.
P. Heinonen, J. Eloranta, K. Kinnunen, T. Kohonen, and K. Noukka.
Water Supply and Management, Vol 4, No 5/6, p 339-369, 1980. 11 Fig, 7 Tab, 50 Ref.

Descriptors: *Water quality, *Cost-benefit analysis, *Model studies, *Finland, Water pollution, Waste water treatment, Industrial wastes, Effluents, Planning, Lake Paijanne(Finland), World Bank, KVT project, Pollutant identification, Financing, Participating funds, Cost allocation.

The Republic of Finland initiated a research program on water pollution as a stipulation for a World Bank loan to be applied toward an industrial water protection program scheduled for 1975-1977. This program, known as the KVT project, had several concerns. Manual and automatic monitoring systems measured pollution in various streams and rivers. Literature studies of several aquatic ecological models were applied to Lake Paijanne. Cost-benefit analysis methods were developed to estimate economic efficiency of water protection programs. An effluent charge system was devised to create incentives for industries to minimize their pollution discharges. The World Bank can apply information gathered from these studies toward financing similar projects elsewhere in the world. (Cassar-FRC)
W81-01326

INDIGENOUS RESOURCES AND WATER SUPPLY MANAGEMENT,
International Labour Organization, Geneva (Switzerland). Employment and Development Dept.
For primary bibliographic entry see Field 4B.
W81-01329

A POST AUDIT EVALUATION OF METHODOLOGY FOR WILD AND SCENIC RIVER DEVELOPMENT AND MANAGEMENT, THE CLEARWATER RIVER, IDAHO: A CASE STUDY,
Idaho Univ., Moscow. Dept. of Agricultural Economics.
R. O. Brooks, and E. L. Michalson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157109, Price codes: A04 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, University of Idaho Completion Report, August, 1980. 53 p, 3 Fig, 11 Tab, 25 Ref, 2 Append. OWRT-C-7511(No 6233)(1), 14-34-0001-6233.

Descriptors: *Surveys, *Wild River Act, *Scenic easements, *Evaluation, *Water resources develop-

ment, Public benefits, *Surveys, Wild rivers, Scenery, Legislation, Water policy, Baseline studies, Legal aspects, Recreation, Running waters, Rivers, Easements, Public access, Natural resources, Zoning, Water resources, Benefits, Assessments, Idaho, Economic import, Agriculture, Forestry, Mining.

Statistical techniques were used to analyze the scenic easement program, as well as economic impacts on the value of agricultural, timber, and mining resources. By compiling data on these resources over time, it was possible to estimate the change in value caused by the 1968 Wild and Scenic Rivers Act. Data were collected by means of structured and unstructured interviews held with Forest Service personnel, county officials, and local industry owners and managers, and by use of structured questionnaires administered to private landowners within the river corridor. The results of the analysis showed that the classification of the Middle Fork of the Clearwater has not had any significant economic affect on any of the area's resources, except for the value of land encumbered with scenic easements. The restrictions imposed on the agricultural, timber, and mining resources have not and will not curtail their productive services or limit their growth. The least squares regression model used to estimate scenic easement payments indicated that appraisal techniques employed by the various appraisers were consistent and acceptable. (Zielinski-IPA)
W81-01379

A POST AUDIT EVALUATION OF METHODOLOGY FOR WILD AND SCENIC RIVER DEVELOPMENT AND MANAGEMENT, THE CLEARWATER RIVER, IDAHO: A CASE STUDY OF PUBLIC INVOLVEMENT PRACTICES,
Idaho Univ., Moscow. School of Communications.
J. K. VanLeuven.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157125, Price codes: A06 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, University of Idaho Completion Report, August, 1980. 91 p, 33 Tab, 20 Ref, 1 Append. OWRT-C-7511(No 6233)(2), 14-34-0001-6233.

Descriptors: *Wild River Act, *Scenic easements, *Evaluation, *Water resources development, *Public benefits, *Surveys, Wild rivers, Legislation, Scenery, Water policy, Recreation, Baseline studies, Rivers, Running waters, Easements, Legal aspects, Public access, Zoning, Natural resources, Water resources, Benefits, Assessments, Idaho.

The uniqueness of the Idaho Clearwater Wild River Program, the Nation's first wild river program, was delineated from a planning standpoint. Methodologies were designed to recognize the nature of this ten-year-old program and to suggest a validity procedure for measuring the human impacts of other established water resource programs. The program covers the Clearwater Middle Fork, including the Lochsa and Selway Rivers. Three principal methodologies were used: (1) an attitude survey of 280 affected landowners and public involvement participants, designed to show any discrepancies between orginal expectations and current assessment of the program; (2) a personal value analysis to indirectly assess how members of nine affected interest groups felt their personal values/ideals have been served by the program, to provide a validity measurement; and (3) application of the 1969 and 1970 public involvement/information programs to the public involvement objectives of the U.S. Forest Service's 1977 'Inform and Involve' draft handbook. The results of this study supported the initial program efforts and recommended that additional public involvement techniques be implemented. Three formats were suggested for a new ongoing program: (1) neighborhood workshops, (2) a wild river program newsletter, and (3) an educational program for tourists, school children, and others less aware of the program. (Zielinski-IPA)
W81-01380

APPROPRIATE TECHNOLOGIES FOR WATER SUPPLIES AND SANITATION IN NORTHERN COMMUNITIES,
International Development Research Center, Ottawa, (Ontario). Health Sciences Div.
M. G. McGarry, T. Jackson, W. Rybczynski, A. V. Whyte, and A. P. Zimmerman.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 121-135. 1 Fig.

Descriptors: *Canada, Indian reservations, *Sanitary engineering, *Cold regions, *Sewage disposal, Environmental sanitation, Public health, Enteric bacteria, Eutrophication, Water supply, Education, Epidemics, Human diseases, Potable water.

The Big Trout Lake Indian Reserve on Post Island, west of James Bay in Northern Ontario, is an example of community participation in the design of water and sanitation facilities in Indian communities in the north. Like most Indian communities in northern Canada, the 600 Cree-speaking indigenous people of the reserve are dependent on buckets in the summer and ice block collection in the winter as a water source. A team of professionals with international development experience in water supplies and sanitation was brought in and emphasis was placed on community participation. The team found that sewage from the community would have to be contained to stop eutrophication and fecal contamination of the lake, a major water source for the community. No native houses were found to have piped water and pit latrines were used for defecation. The team recommended a dynamic process of improvements as no single technology could be uniformly applied and afforded. Water supply alternatives include catchment by roof, hand pumps, street taps or standpipes, and truck delivery. Excreta disposal alternatives include improved or lined pit latrines, moldering toilets, and a truck collection system. Big Trout Lake illustrated that how choices are made is as important as what choices are made, and community education is of high priority. (See also W81-01381) (Seigler-IPA)
W81-01387

INTRODUCTION TO FIRE PROTECTION IN THE NORTH,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
G. W. Heinke.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 223-224.

Descriptors: *Fire protection, *Cold regions, *Northern regions, *Burning, Insurance, Protection, Risks, Cost analysis, Evaluation, Value engineering, Cost-benefit analysis.

To achieve an adequate level of fire protection and prevention in northern communities the real requirements must be examined, objectives for public and private systems must be stated, and a suitable system must be designed and maintained. Most northern communities are small and do not have the funding or management capabilities to own and operate an adequate fire system. Other factors making fire protection in the north difficult include extremely low temperatures, high winds, drifting snow, dry air, long heating seasons, community isolation, and the lack of adequate roads. There is also the problem of who mans the fire equipment, a paid or volunteer brigade. In most cases a combination is desirable. The prime requirement of any system is its readiness to serve. Another factor that must be considered is the level of protection needed to reduce insurance rates. Too often towns that do develop good systems are not rewarded with lower rates because they are too small for differential rates. (See also W81-01381) (Seigler-IPA)
W81-01392

FIRE PROTECTION IN THE NORTH,
Construction for the Government of the Northwest Territories, Yellowknife Safety Div.
L. Adrian.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 225-229. 1 Fig.

Descriptors: *Canada, *Northwest Territories, *Fire Protection, *Cold regions, Protection, Standards, Fire extinguishers, Building codes, Fire brigades, Education, Smoke detectors, Fire halls, Zoning, Organizational structure.

The Fire Prevention Ordinance of the Northwest Territories is designed to provide the best fire protection within the limits of the economic factors of the area. The Northwest Territories have many extremes since they cover approximately one third of Canada. The population of 46,000 people is scattered over this area making fire protection difficult. The Fire Marshall must record all reported fires, report annually to the Commissioner, and review building plans to ensure that they conform to standards. Building codes require at least two fire extinguishers in every home and the Yellowknife and Inuvik areas require smoke detectors in every area with sleeping quarters. The Department of Local Government purchases fire protection equipment for all settlements including hamlets; villages, towns, and cities purchase their own. Due to the varying terrain of the area, a standard for equipment is not possible. Every community has organized fire brigades that are, in general, volunteer. Fire hall complexes consist of a combined fire hall and settlement office with a two-bay garage and training facilities. Zoning codes provide for proper distances between buildings and students are trained in the use of fire extinguishers. (See also W81-01381) (Seigler-IPA)
W81-01393

FIRE PROTECTION CONSIDERATIONS IN REMOTE, COLD REGIONS COMMUNITIES,
Indian Health Service, Window Rock, AZ. Navajo Area Indian Health Service.
W. L. Ryan.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 230-233.

Descriptors: *Fire protection, *Cold regions, *Sprinklers, *Building codes, Protection, Fire extinguishers, Smoke detectors, Fire hydrants, Insurance, Cost analysis, Water distribution, Value engineering, Risks, Burning.

Fire is a major problem in cold regions and practical solutions must be used rather than relying on the standard solutions suited for more temperate areas. The great danger from fire in cold areas comes from the length and severity of the heating season, lack of adequate water distribution, high winds, and poor roads. Due to the high cost of water distribution, the fire codes and prevention standards superimposed by insurance companies are not realistic for small isolated northern communities. The primary goal of saving lives can be aided in the north by having adequate fire escapes, well marked exits, smoke alarms, and community fire alarm systems. Sprinkler systems should be installed in homes and public buildings. Other good protection measures include a faucet in the home with a garden hose attached and hand operated fire extinguishers. Fire hydrants and tank truck systems have often proved ineffective in cold regions due to the elapsed time in getting to a fire, and fire hydrants that are frozen. Several communities have novel approaches such as the use of the airport snowblower in Unalakleet, Alaska, to dump snow on burning buildings. (See also W81-01381) (Seigler-IPA)
W81-01394

FIRE PROTECTION IN ISOLATED NORTHERN COMMUNITIES,
Office of Dominion Fire Commissioner, Ottawa (Ontario).
R. G. Whatmough.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5,

October, 1980, p 234-236.

Descriptors: *Canada, *Fire protection, *Cold regions, Fire extinguishers, Burning, Protection, Building codes, Combustion, Water distribution, Sprinklers, Standards, Fire departments.

Factors affecting fire protection in northern areas include the following: a long continuous heating season, the prevalent use of combustible building materials, poor road conditions, lack of trained tradesmen for services and repairs to equipment, and the use of portable water instead of piped water. The National Building Code of Canada and the National Fire Code set standards to aid in providing fire protection for northern communities. However, the building code is based on an adequate water supply with a full-time fire department while most northern communities have a volunteer fire department and a portable water supply. Due to this, an early alerting system and a regular fire inspection program are essential. The water supply needed for fire protection is determined by building size, type of construction, occupancy classification, fire fighting response time, fire fighting capability, and exposures to building. Often the water supply to a building does not provide sufficient pressure for a sprinkler system. In this case, pressure tanks filled with water and air at all times can be used. Despite the damage that water can cause, especially when it freezes, it remains the most general, all-round efficient extinguishant for controlling structural fires. (See also W81-01381) (Seigler-IPA)
W81-01395

SANITATION FACILITIES OPERATION AND MAINTENANCE IN ALASKAN NATIVE VILLAGES,
Alaska Area Native Health Service, Anchorage.
D. R. Rogness.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 239-247.

Descriptors: *Alaska, *Public utilities, *Operation and maintenance, *Sanitary engineering, *Sewers, *Water works, *Reliability, Education, Management, Maintenance costs, Operations, Cold regions, Inspection, Water systems, Hydraulic structures.

For three years the Alaska Area Native Health Service has conducted a program to provide maximum support to Alaska Native villages in the operation and maintenance of their water and sewer systems. The program does not directly subsidize the operation and maintenance of a system, rather it prepares and trains the village operators and citizens so that they are able to increase the reliability of system operations. After funding but prior to design and construction, a trained team visits a village several times to explain design alternatives and the amount of maintenance required by each. The village's responsiblity for operation and maintenance is stressed. This has lead to the selection of simpler central-type facilities that are less expensive and easier to operate and maintain. During construction, village operators receive on-site training that is followed by a five-day formal training course geared to the educational and expertise levels of the individuals, and to their own particular systems. Once a system is in operation maintenance specialists visit at least twice a year to provide on-the-job training for local operators and to perform any repairs that are beyond the operator's ability. Finally, an operation and maintenance manual is developed for each individual system using extensive pictures of all the components of the actual system. (See also W81-01381) (Seigler-IPA)
W81-01396

OPERATION, MAINTENANCE AND MANAGEMENT ASSISTANCE FOR RURAL SANITATION FACILITIES,
Alaska State Dept. of Environmental Conservation, Juneau.
J. W. Sargent.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 248-259. 2 Ref.

Descriptors: *Alaska, *Sanitation facilities, *Operation and maintenance, Rural areas, Cold regions, Public utilities, Sanitary engineering, Water works, Education, Management, Operations, Maintenance costs, Water systems, Public health.

The Alaska Village Safe Water (VSW) program, administered by the Alaska Department of Environmental Conservation (ADEC), conducts an operation and maintenance support program that offers financial, technical, and management assistance to the villages that have VSW sanitation facilities. A dominant feature of the program is the delegation of management program activities, as much as possible, to the villages themselves. Efforts are made to minimize direct State involvement in the management of VSW facilities. Villages may choose to accept the assistance and enter into a contract with ADEC and agree that funds will be spent according to the contract. Grant needs vary from 0 to 85% of the operating budget for a facility depending upon the village. Professional and technical services are provided by a field engineer who holds a separate contract with each village. He must be a 'Jack-of-all-trades' and must perform all activities reasonably required for administration, management, operation, and maintenance of a facility. A commercial bookkeeping firm handles the funding of the money to the villages. This VSW program is not a long-term solution to operational problems, but is simply designed to prevent the failure of existing VSW facilities before a solution is available. (See also W81-01381) (Seigler-IPA)
W81-01397

SOLVING SNOW-DRIFTING PROBLEMS AT BAKER LAKE, N.W.T., USING SNOW-MODELLING TECHNIQUES,
Interdisciplinary Engineering Co., Winnipeg (Manitoba).
K. M. Adam, and R. Piotrowski.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 394-408. 1 Fig, 1 Ref.

Descriptors: *Cold regions, *Model studies, *Snow drifting, *Snowpacks, *Snow management, Snow, Hydraulic models, Winter, Hydraulic similitude, Testing, Canada, Flumes, Northwest Territories, Winds, *Baker Lake(NWT).

Three hydraulic models were constructed for snow modelling at Baker Lake, a community of 1100 people located 240 km south of the Arctic Circle. The terrain is barren allowing snow to blow into the settlement from many kilometers to the north and it is common for several houses to be completely buried in winter. One model was a scale of one to one thousand of the whole townsite and surrounding terrain. A strip through Baker Lake parallel to the prevailing wind direction was modelled at one to four hundred. The third model, at a scale of one to four hundred was of the area of the proposed recreation center. Models were made of wood, concrete, and plasticine. The models were tested in a hydraulic flume with sand introduced into the water to simulate blowing snow. Results show that large obstructions upwind of the townsite will reduce the drifting problem. Staggered intermittent barriers of end-dumped or pushed up snow are more effective than a continuous barrier. Baker Lake constructed snow barriers at designated locations and they kept a previously impassable road from the settlement to the airport open. Sand-water modelling can help to find solutions to snow drifting at reasonable costs because the cost of model construction and testing is minimal compared to the construction of untested field solutions that fail. (See also W81-01381) (Seigler-IPA)
W81-01405

6D. Water Demand

QUENCHING THE THIRST FOR POTABLE WATER IN ARID SAUDI ARABIA,
American Water Works Association Research Foundation, Denver, CO.
For primary bibliographic entry see Field 6A.
W81-01287

DEVELOPMENT OF IMPROVED WATER MANAGEMENT PRACTICES IN PAKISTAN,
Colorado State Univ., Fort Collins. Engineering Research Center.
For primary bibliographic entry see Field 6A.
W81-01328

DOMESTIC WATER CONSUMPTION IN URBAN AREAS: A CASE STUDY IN IBADAN CITY, NIGERIA,
Ibadan Univ. (Nigeria). Dept. of Geography.
F. O. Akintola, and O. Areola.
Water Supply and Management, Vol 4, No 5/6, p 313-321, 1980. 1 Fig, 7 Tab, 3 Ref.

Descriptors: *Domestic water, *Water consumption, *Planning, Water management, Ibadan(Nigeria), *Nigeria, Water utilization, Projections, Water supply, Domestic water.

A study of residential water use in an upper middle class area of Ibadan, Nigeria, was undertaken to provide information for estimating future public water needs. Results of surveys in 565 households in three distinct areas show that residents in the more modern sections have a much higher water consumption (86 liters per day) than the national average (46 liters per day). Although the consumption rate is near that in advanced countries, most households surveyed are not yet equipped with appliances which use large quantities of water. Major uses of water are in toilets, floor scrubbing, car washing, and bathing. Water consumption is related to availability. For example, car washing uses 18 liters in areas where water is carried in buckets; 72 liters when hoses are available. Planners must base estimates of future water needs, not only on total population, but also on expected improvements in socio-economic status and living standards, which increase per capita water consumption. Policies proposed to limit excessive water use are water meters, increased rates, and modification of appliances. (Cassar-FRC)
W81-01333

6E. Water Law and Institutions

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN, GOALS AND OBJECTIVES, 1982-1986.
Minnesota Univ., St. Paul. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156648, Price codes: A05 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, November, 1980. 82 p, 11 Fig, 8 Tab, 26 Ref.

Descriptors: *Minnesota, *Research priorities, *Planning, *Research and development, *Water resources, Water utilization, Water quality, Waste water(Pollution), Water conservation, Optimum development plans, Water policy, Water supply, Institutions, Water distribution(Applied), Wetlands, Water pollution, Groundwater, Water analysis, Water quality control, Water resources planning, *Five-year plans.

The State of Minnesota 1982-1986 five-year water resources plan includes a review of the State's water resources, their current and projected uses, water and related land planning and development activities, problems, and concerns of citizens groups and agencies, priorities of the Water Resource Research Center, and the five-year research, development, and technology transfer plans of the Center. Problems most urgently perceived as needing research were classified into five

area categories, with the State locations or agencies that expressed the research need indicated in the category sub-area listings. The prioritized categories (and sub-areas) were: (1) water quantity, supply, and distribution research needs (resource inventory, groundwater hydrology, water supply and storage); (2) water quality research needs (pollution standards, water quality data and data collection, health aspects, protecting groundwater from pollution, non-point source pollution, point source pollution, and waste water handling/purification); (3) conservation and water use efficiency (wetlands, storage/reuse); (4) economic/social/institutional (regional planning/feasibility, public education, data and information); and (5) water resources management (management of non-point pollution/wetlands/floods, data and prediction, water recycling/reuse, and water energy relationships). (Zielinski-IPA)
W81-01207

REGIONAL FIVE-YEAR (1982-1987) WATER RESOURCES RESEARCH: GOALS AND OBJECTIVES.
Utah Center for Water Resources Research, Logan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156622, Price codes: A03 in paper copy, A01 in microfiche. Pacific Southwest Region, Report submitted to the Office of Water Research and Technology, December, 1980. 37 p, 10 Tab, 8 Ref.

Descriptors: *Southwest U.S., *Research priorities, *Planning, *Research and development, *Regional analysis, *Water resources planning, Regions, Pacific coast region, Water resources, Water utilization, Water quality, Water pollution, Water conservation, Optimum development plans, Water supply, Water policy, Institutions, Water distribution(Applied), Runoff, Water analysis, *Five-year plans(Pacific SW region).

State five-year water resources research programs have been prepared for Arizona, California, Colorado, Nevada, New Mexico, and Utah. This regional plan has drawn on the State plans for descriptive information on State water resources, water uses and needs, research and planning activities, and water management problems to assist the identification of regional priorities for collective research. Fifteen regional research topics were identified and priority ranked as very high or high. Those topics rated as having very high regional priority were: (1) legal/institutional aspects of allocation of new (including cloud seeking, evaporation suppression, water harvesting) and newly quantified water supplies, and reallocation of existing supplies; (2) conjunctive management of surface waters and groundwaters; (3) contamination of groundwaters and surface waters by heavy metals, organics, and other toxic materials; (4) salt pickup processes in surface waters and movement through channels/reservoirs, for use in more effective water management and methods of salinity control; and (5) effects of mining activities (metals, fossil fuels, and others) on surface runoff, water quality, and groundwater movement and quality. These priority topics were assigned to separate States for assembling regional research teams. (Zielinski-IPA)
W81-01209

PROTECTING INSTREAM FLOWS IN MONTANA: YELLOWSTONE RIVER RESERVATION CASE STUDY,
Cooperative Instream Flow Service Group, Fort Collins, CO.; and Fish and Wildlife, Fort Collins. Western Energy and Land Use Team.
D. A. Sweetman.
Instream Flow Information Paper No 10, Report FWS/OBS-79/36, September, 1980. 85 p, 24 Ref, 5 Append.

Descriptors: *Water allocation(Policy), *Water law, *Streamflow, *Water permits, Montana, Water utilization, Non-consumptive use, Competing uses, River flow, River basins, Water rights, Wildlife conservation, Water quality, *Yellowstone River Basin(MT).

The method used by the Montana Board of Natural Resources and Conservation in making water reservation determinations in the Yellowstone River Basin is reviewed to provide information as to the usefulness of this form of water allocation. While the Yellowstone has a mean annual flow of 8.8 million acre feet, the all-time low was approximately 4.1 million acre feet: in some years it is possible to satisfy all water uses, while in other years many users will be unsatisfied. The Montana Water Use Act of 1973 established a permit system for all new water rights, and recognized instream rights. Thirty water reservation requests were submitted to the board, including nonconsumptive use requests for almost the entire average flow to protect wildlife, recreation and water quality. The reservations established by the Board's actions secured water rights provided for minimum stream flows, and allowed for future water utilization in areas other than those addressed under the reservation process. Implementation of the instream flows granted in the Yellowstone Basin may serve to protect the continued existence of one of the Nation's last remaining free-flowing rivers. The reservation process appears to have been well accepted in this case, with only two parties appealing the decisions. (Moore-SRC)
W81-01219

INSTREAM FLOW NEGOTIATION: REVIEW OF PRACTICES,
M. R. White, F. D. Valdez, and M. D. White.
Fish and Wildlife Service, Biological Services Program Report FWS/OBS-80/53, September, 1980. 78 p, 26 Ref.

Descriptors: *Negotiations, *Streamflow, *Water rights, Attitudes, Legal aspects, Decision making, Water utilization, Flow rates.

This review summarizes research, findings, and recommendations of practitioners in the art of negotiation, and applies them to negotiations undertaken to preserve and protect instream flows. Negotiation is a method of social decision-making, consisting of choices involving another party, accomplished by persuasion and haggling. Negotiators may choose between clear-cut alternatives, but more often must balance and weigh values on the way to an agreement. Negotiators may or may not define the issues in the same way, gradually converge toward a compromise situation, agree on the value of issues, and agree on relative bargaining power. Most negotiations involve both bargaining and debate. Negotiators cooperate to increase their common interest as well as their individual interests. It is difficult to find a single standard by which to judge negotiation, negotiators, or outomes. Bargaining reputation is extremely important, and face-saving is a powerful motive in negotiation. Negotiators are reluctant to yield or concede a point and are unwilling to acknowledge concessions they have made. For this reason, concessions may occur only in the context of a trade. Negotiating behavior is shaped by the context for negotiation, including the issues, their complexity, the team structure, and the team style. (Moore-SRC)
W81-01230

STATE OF THE STATES: WATER RESOURCES PLANNING AND MANAGEMENT.
Water Resources Council, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182975, Price codes: A08 in paper copy, A01 in microfiche. Report, April, 1980. 153 p, 10 Tab, 37 Ref, 4 Append.

Descriptors: *Planning, *Water resources, *Water management(Applied), *Water quality control, State governments, Water supply, Regional development, Water law, Overdraft, Erosion, Floods, Wetlands, Permits, Legislation, Flood plains, Comprehensive planning, Water resources development.

This study was conducted to take stock of water resources planning and management trends at State and regional levels, as well as those water resources issues that confront State and regional efforts. It provides an overview of quality and quantity planning and management activities and summarizes the current status of State water quality planning, regulation, standard setting, wastewater facility construction, and other management activities. Virtually every State and region is experiencing a range of water resources problems, the most frequently noted being: overdraft of groundwater; erosion and sedimentation of river banks; and flooding, caused by the development of wetlands and floodplain, and insufficient management techniques. States' legislative authorization for addressing water resources problems vary widely. Two states, Delaware and Florida, have recently mandated totally comprehensive approaches to the planning and management of water resources, while 27 additional States have authorized some form of comprehensive water resources planning. Western states have tended to integrate water quality planning and management functions into a single agency, while northeastern States have been more apt to integrate water quality and quantity planning into a single agency. The legislative trend in the management of water resources is toward the establishment of some sort of permit system. (Moore-SRC)
W81-01233

EVOLUTION OF THE WATER AND SANITATION POLICY AND PROGRAM IN THE NORTHWEST TERRITORIES,
Construction for the Government of the Northwest Territories, Yellowknife Dept. of Local Government.
V. Christensen.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 9-18.

Descriptors: *Canada, *Northwest Territories, *Water policy, *Cold regions, *Sanitary engineering, Waste disposal, Plumbing, Public health, Sewage, Water storage, Water supply, Sewage disposal, Sewerage, Environmental sanitation.

Since its establishment in 1976, the Water and Sanitation Section of the Department of Local Government has made substantial progress with the problems of water and sanitation services in the Northwest Territories. Despite this progress another six to eight years will be needed to provide an acceptable level of service across the Territories. Although the first Northwest Territories Council was established in 1875, it was not until the 1960's that the need for improved water and sanitation services was recognized. Prior to 1976 most of the area's water policies were inefficient due to inadequate funding and lack of engineering experience with the cold climate. Current policy is being modified on an ongoing basis to develop a policy compatible with the prevailing social and economic conditions in the Territories. A major impediment to improved water and sanitation services remains the poor standard of housing in the northern communities. All new houses are now being provided with larger water and sewage storage tanks to end the need for bagged sewage collection. Projects are also underway to inform the public of the reasons and management methods for proper garbage collection and disposal systems. (See also W81-01381) (Seigler-IPA)
W81-01382

6G. Ecologic Impact Of Water Development

EFFECTS OF ALTERATIONS TO LOW GRADIENT REACHES OF UTAH STREAMS,
Utah Cooperative Fishery Research Unit, Logan.
R. S. Wydoski, and W. T. Helm.
Fish and Wildlife Service, Biological Services Program, Report FWS/OBS-80/14, April, 1980. 178 p, 48 Fig, 45 Tab, 130 Ref, 6 Append. 14-16-008-1141.

Descriptors: *Stream improvement, *Sport fish, *Invertebrates, *Fish populations, Channel morphology, *Utah, Streambeds, Dredging, Aquatic habitat, Stream erosion, Fish reproduction, Stream

fisheries, *Environmental effects, Biomass, Flood control, Trout, Ecology.

Stream channels in the semi-arid intermountain west have been modified for many years by agricultural interests, primarily to provide flood protection. Of special concern is the relationship between stream channel modification and the high value fishery resource. This report describes an investigation of the effects of stream channelization on fish and macroinvertebrates in low gradient reaches of Blacksmith Fork River and the Logan River in the floodplain of Cache Valley in northern Utah. Dredged, recently bulldozed, and old bulldozed sites, plus two control areas, were selected for study. Erosion and deposition of streambed gravel were directly correlated with the percentage of stream reach that was altered. High stream flows in spring appeared to be required to maintain the depth and frequency of pools. Channelization adversely affected both fish and macroinvertebrate populations and biomass, with the severity of impact directly related to the amount and duration of disturbance of the physical habitat. In all bulldozed sites the trout populations were not self-sustaining. Dredging had less effect than bulldozing on survival of age 0 fish, but dredging may reduce spawning in the future. Water temperature, water chemistry, sampling information, a macroinvertebrate list, and length and weight information on invertebrates is provided in microfiche appendices. (Moore-SRC)
W81-01224

SUMMARIES OF RIPARIAN AND STREAM ALTERATION STUDIES COMPLETED BY THE EASTERN ENERGY AND LAND USE TEAM.
Fish and Wildlife Service, Kearneysville, WV. Eastern Energy and Land Use Team.
For primary bibliographic entry see Field 10C.
W81-01228

WESTERN STATES INVENTORY OF LOW-HEAD HYDROELECTRIC SITES, VOLUME 2, APPENDIX D, ENVIRONMENTAL SCREENING.
Tudor Engineering Co., San Francisco, CA.
Water and Power Resources Service Report, October, 1980. 283 p. DV-00031.

Descriptors: *Sites, *Hydroelectric plants, *Social aspects, *Environmental effects, Recreational facilities, Parks, Natual resources, Wildlife habitats, Wild rivers, Scenery, Federal reservations, Public lands, Data collections, Water resources development, Reservoir sites, Regional analysis, Western states.

The low-head hydroelectric sites left after the preliminary economic sizing and analysis were screened to identify those which indicated the highest promise of development based on environmental and social concerns. A broad data base was developed that identified the location and potential seriousness of recognized constraints on future hydropower developments. A graduated system of constraint categories was developed, designating them as either Serious, Potentially Serious or Minor. Serious constraints include: wild, scenic and recreational rivers; listed wilderness areas; areas established as parks, monuments, refuges, and wildlife managment areas; areas listed as historical places, landmarks, and research natural areas; and areas established as critical habitats for endangered or threatened species. Potentially Serious constraints are those that have high probability in the future, or upon further project feasibility investigations of being serious constraints. Minor constraints are those which could be overcome with reasonable mitigation measure, and which would probably not preclude development, such as National Forests. This information is provided in tabular form for sites in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. (Moore-SRC)
W81-01232

EFFECTS OF ALTERATIONS TO LOW GRADIENT REACHES OF UTAH STREAMS: SUMMARY,
Utah Cooperative Fishery Research Unit, Logan.
R. S. Wydoski, and W. T. Helm.
Fish and Wildlife Service, Biological Services Program, Report FWS/OBS-80/13, April, 1980. 17 p, 8 Fig. 14-16-0008-1141.

Descriptors: *Stream improvement, Sport fish, *Invertebrates, *Fish populations, Channel morphology, *Utah, Streambeds, Aquatic habitat, Stream erosion, Dredging, Stream fisheries, *Environmental effects, Biomass, Flood control, Brown trout.

Stream channels in the semi-arid intermountain west have been modified for many years by agricultural interests, primarily to provide flood protection. Of special concern is the relationship between stream channel modification and the high value fishery resource. This report summarizes an investigation of the effects of stream channelization on fish and macroinvertebrates in low gradient reaches of Blacksmith Fork River and the Logan River in the floodplain of Cache Valley in northern Utah. Erosion and deposition of streambed materials were directly correlated with the length of stream that was altered and the type of alteration. Channelization adversely affected both fish and macroinvertebrate populations and biomass, with the severity of impact directly related to the amount and duration of disturbance of the physical habitat. Populations, biomass and production of brown trout and mountain whitefish appeared to be directly related to the proportion of the stream reach that contained pools. (Moore-SRC)
W81-01234

WATER QUALITY AND ENVIRONMENTAL IMPACT MODEL OF THE UPPER NILE BASIN,
Royal Danish School of Pharmacy, Copenhagen. Dept. of Chemistry.
S. E. Jorgensen.
Water Supply and Management, Vol 4, No 3, p 147-153, 1980. 4 Fig, 1 Tab, 6 Ref.

Descriptors: *Model studies, *Water quality, *Nile River, River basin development, Watershed management, River systems, Future planning, Surveys, Environmental effects, DDT, Eutrophication, Zooplankton, Nutrients, Snails, Irrigation, Industries.

The HYDROMET project, which is an international survey effort on the Nile River Basin, has been given approval for expansion into a water quality model to give information on lakes, eutrophication, aquatic life, irrigation, industrial wastes and environmental impact. To meet all of these objectives accurately, more comprehensive biological data collection procedures have been adopted with storage of information into a data base, and submodels have been formulated which will feed data into the system. Areas of focus of the smaller models include algal growth, zooplankton, fisheries, nutrient exchange between sediment and water, mass balances of P, N, Si, O, and C, a bilharziosis (snail) model, DDT, Cu and the water and salt balance. Flow charts for each submodel and calibration data are examined to simplify the understanding of the main model. The water quality model will be an important management tool in the Lake region as this area becomes more developed. The model will also help in the decision making process and in the planning of environmental policy. An example of the application of the model to the decision making process on a contrived scheme to build an ammonia fertilizer factory in the area is given. The model will require an intensive training program on its proper use plus a system of dynamic feedback from applied situations to ensure its validity in comprehensive planning and water quality management. (Geiger-FRC)
W81-01330

7. RESOURCES DATA

7A. Network Design

SURFACE WATER DATA, ATLANTIC PROVINCES, 1979.
Water Survey of Canada, Ottawa (Ontario). Inland Waters Directorate.
Report, 1980. 111 p.

Descriptors: *Surface water availability, *Gaging stations, *Canada, *Streamflow, *Basic data collections, Monitoring, Flow measurement, Bodies of water, Surface waters, Rivers, Running waters, Water resources, Streams, Data collections, On-site data collections, Hydrologic data, Measurement, Networks, Stations, Statistics, Flow rates, Discharge(Water), Water levels, *Atlantic Provinces(Canada).

Surface Water Data reports have been published in various formats in imperial units since 1908 in approximately 270 publications. This is the first report presented in the International System of Units (SI). The format has remained the same, with Canada divided into eight regions. The provinces usually each represent a separate region, but the Atlantic Provinces region is comprised of New Brunswick, Newfoundland, Nova Scotia, and Prince Edward Island. The present report covered the results of the hydrometric survey investigations made in the Atlantic Provinces (including Labrador) for the 1979 calendar year. These data are published annually on a calendar year basis, and the stations are listed alphabetically, with yearly data on two stations given per page. The general method for data tabulation included (1) a table of daily water level or discharge, (2) a summary of monthly and annual data, and (3) descriptive information (such as gauge type, gauge location, drainage area). (Zielinski-IPA)
W81-01214

SURFACE WATER DATA, YUKON AND NORTHWEST TERRITORIES, 1979.
Water Survey of Canada, Ottawa, (Ontario). Inland Waters Directorate.
Report, 1980. 88 p.

Descriptors: *Basic data collections, *Canada, *Gaging stations, *Surface water availability, *Streamflow, Monitoring, Flow measurement, Bodies of water, Surface waters, Rivers, Running waters, Water resources, Streams, Data collections, On-site data collections, Hydrologic data, Measurement, Networks, Stations, Statistics, Flow rates, Discharge(Water), Water levels, *Yukon, *Northwest Territory(Canada).

Results of the hydrometric survey investigations are presented in terms of daily discharge rates (cubic meters per second) for each day of 1979 for the various stations in the Canada region represented by the Yukon and Northwest Territories. This is one of eight regions that Canada is divided into for the purpose of these Surface Water Data compilations. Surface Water Data reports have been published in various formats in imperial units since 1908 in approximately 270 publications. This is the first report presented using the International System of Units (SI). These data are published annually on a calendar year basis. The report represents the data of the stations alphabetically, with yearly data on two stations per page. The general method for data tabulation for each station has included (1) a table of daily discharge rates or daily water levels, (2) a summary of annual and monthly data, and (3) descriptive information (such as gauge type, gauge location, and drainage area in kilometers). Highest annual discharge rates generally occur within the May-September time-frame. (Zielinski-IPA)
W81-01215

WATER QUALITY MONITORING--SOME PRACTICAL SAMPLING FREQUENCY CONSIDERATIONS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.

J. C. Loftis, and R. C. Ward.
Environmental Management, Vol 4, No 6, p 521-526, November, 1980. 2 Fig, 15 Ref.

Descriptors: *Sampling, *Water sampling, Monitoring, *Water quality, Mathematical studies, Network design, Water analysis, Illinois, Frequency, Seasonal.

Relationships between water quality sampling frequency in a monitoring network and the effect of statistical methods and assumptions on sampling frequency were examined. Detailed data from the Illinois State Water Survey network was studied using 3 methods: (1) considering neither seasonal variation nor serial correlation (the most widely used method), (2) considering only seasonal variation, and (3) considering both seasonal variation and serial correlation (assumed to be the most accurate method). Confidence level widths for each were plotted as a function of sampling frequency, which were divided into 3 regions with zones of uncertainty between each region. In Region 1 (sampling interval, 1-12 days), Method 3 is most accurate; in Region 2 (sampling interval, 12-34 days), Method 1 or 3 apply; and in Region 3 (sampling interval greater than 34 days), Method 1. (Cassar-FRC)
W81-01257

SAMPLING AND THE REGULATORY MAZE IN THE UNITED STATES,
Illinois Environmental Protection Agency, Springfield.
D. J. Schaeffer, J. B. Park, H. W. Kerster, and K. G. Janardan.
Environmental Management, Vol 4, No 6, p 469-481, November, 1980. 1 Fig, 52 Ref.

Descriptors: *Sampling, *Regulation, *Water quality standards, Illinois, Monitoring, Water pollution control, Cyanide, Ammonia, Standards.

The problem of sampling is related to the maze of environmental regulation in the United States. Actions that develop from regulations affect sampling, and conversely, analyses and sampling are used as a basis for setting standards. Procedural problems are illustrated by the example of the dieldrin residue limit for animal feed established by the U.S. EPA. This standard was set by relying on the fish bioaccumulation factor rather than acute and chronic toxicity data, arriving at a value of 0.005 ppb, which is not detectable except by the most refined research techniques. This makes routine sampling and analysis suspect. Suggestions are made for improvements to the National Pollutant Discharge Elimination System reporting system, to make the data received more useful. Testing and analysis problems are illustrated by the cyanide standards hearings held in Illinois, which took 3 years to develop a 0.005 mg per liter standard, a level which requires development of new analytical methods. Two groups within EPA are now working on the ammonia effluent standards, making possible a double set of regulations. Recommended sample preservation procedures are frequently impractical and expensive. However, in the case of phenol sampling, only one general sentence was given as instruction. Further problems involve collection of composite samples, trace organic compounds, rounding of results, and lack of objectives described for the data acquired. (Cassar-FRC)
W81-01258

ANALYTICAL ISSUES IN COMPLIANCE MONITORING,
J. K. Rice.
Environmental Science and Technology, Vol 14, No 12, p 1455-1457, December, 1980. 2 Tab.

Descriptors: *Water analysis, *Monitoring, Data collection, Data acquistion, Analytical techniques, Measurement.

Modifications are suggested to ensure accurate results in compliance monitoring for pollutant dischargers. It is suggested that steps which will be followed both inside and outside the laboratory for the analysis of water samples be specified in the outlined standard method. These steps are deemed essential to the reliable performance of monitoring. A determination of the overall precision of the monitoring method is needed. The method which is designed and accepted must be applied only to the matrices for which it was validated. When the precision of a method has been determined for a single matrix, this does not allow it to be used universally. Terms used in the process of measurement must be accurately and consistently defined. (Baker-FRC)
W81-01261

ERROR DETECTION SYSTEM FOR CLIMATIC AND HYDROLOGIC DATA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
J. C. Carr, V. O. Shanholtz, and B. B. Ross.
Transactions of the ASAE, Vol 23, No 5, p 1127-1130, October/November, 1980. 1 Fig, 6 Ref.

Descriptors: *Data processing, *Computer programs, *Climatic data, Error detection, Hydrologic data.

This paper summarizes the data error detection phase of the climatic and hydrologic data management program. The package consists of 3 programs, an error diagnostic program which scans input data for errors detectable by computer-based algorithms, a program which updates and corrects basic data files, and a third program, which detects errors in the recording of timing of precipitation and runoff events from a given watershed. Examples of errors detected by this system are gross mistakes in depth and change in a given time increment, incorrect designation of Standard or Daylight Saving Time, evaporation loss in rain gauges, and data out of the proper sequence. (Cassar-FRC)
W81-01276

WATER QUALITY AND ENVIRONMENTAL IMPACT MODEL OF THE UPPER NILE BASIN,
Royal Danish School of Pharmacy, Copenhagen. Dept. of Chemistry.
For primary bibliographic entry see Field 6G.
W81-01330

7B. Data Acquisition

DETERMINATION OF DEUTERIUM/HYDROGEN RATIOS IN NATURAL WATERS BY FOURIER TRANSFORM NUCLEAR MAGNETIC RESONANCE SPECTROMETRY,
Hong Kong Univ. Dept. of Chemistry.
R. S. Tse, S. C. Wong, and C. P. Yuen.
Analytical Chemistry, Vol 52, No 14, p 2445, December, 1980. 2 Ref.

Descriptors: *Isotope studies, *Deuterium, Hydrogen, Spectrometers, Analytical techniques.

A multinuclear Fourier transform nuclear magnetic resonance spectrometer was used to determine deuterium/hydrogen isotope ratios in natural waters. A 2 ml water sample and an internal working standard of lithium iodide in 2% deuterium-enriched acetone were used. Calibration of the standard was done by adding known volumes of deuterium oxide to a sample. Results obtained were as follows: International Atomic Energy Agency V-SMOW No. 268, 155.6 + or - 0.12 ppm (IAEA value, 155.76 + or - 0.05 ppm); SLAP No. 259, 88.8 + or - 0.18 ppm (IAEA value 89.02 + or - 0.05 ppm); local tap water, 153.5 + or - 0.2 ppm. (Cassar-FRC)
W81-01244

CYTOSOME MORPHOGENESIS IN NERVE CELLS AND LATERAL CILIO-INHIBITION IN THE MUSSEL, MYTILUS EDULIS,
Southern Illinois Univ. at Carbondale. Dept. of Anatomy.
A. Paparo, and J. A. Murphy.
Journal of Submicroscopic Cytology, Vol 12, No 4, p 547-562, 1980. 12 Fig, 47 Ref. OWRT-B-119-ILL(1), 14-34-0001-9069.

Descriptors: *Cytological studies, *Aquatic animals, *Mussels, Physiological ecology, Mollusks, Aquatic environment, Light, Temperature, Effects, Central nervous systems, Gills, *Radioisotopes, Analytical techniques.

Visceral ganglion, branchial nerve and gill preparations were studied in the mussel, Mytilus edulis. The ganglia and nerves contain yellow pigment granules (Cytosomes) which are ultrastructurally altered in response to visible light (490 nm). The frequency of the conversions in cytosomes (immature, mature, paracrystalline and lamellar formation) are directly related to the duration of light exposure and temperature. Autoradiographic/radioisotopic incorporation studies indicated that the Golgi apparatus plays a role in the formation of these neutonal pigment granules. The percentage of lamellar type granule conversions can also be influenced by gradual anoxic conditions, i.e., treatment with pentylenetetrazole or dopamine, or high frequency branchial nerve stimulation. Microspectrofluorometric analyses indicate that these parameters also change the absorption spectra of the yellow pigment in cytosomes. Furthermore, lateral cilio-inhibition is observed in those preparations with the greatest number of 'secondary conversions' of cytosomes in their neutons. The magnitude of this cilio-inhibition seems to be related to the percentage of lamellar transformations in cytosomes. Since sequestered calcium has been shown to be released from lamellar-type granules, it is postulated that the cilio-inhibition observed in this study is due to an increase in the neuronal intracellular (Ca++) with subsequent release of the cilio-inhibitory agent, dopamine.
W81-01268

PRESSURE TRANSDUCER FOR REMOTE DATA ACQUISITION,
Robert S. Kerr Environmental Research Lab., Ada, OK.
C. G. Enfield, and C. V. Gillaspy.
Transactions of the ASAE, Vol 23, No 5, p 1195-1196, 1200, October/November, 1980. 5 Fig, 25 Ref.

Descriptors: *Transducers, *Pressure measuring instruments, *Remote sensing, Manometers, Instrumentation, Soil water, Irrigation.

An inexpensive pressure transducer, applicable to most water management and research needs, has been developed for automated data acquisition in the field. This device, based on a standard mercury manometer, is linearly temperature-dependent and gives a frequency output as a function of pressure output. Construction materials are nylon tubing, stainless steel tubing, shielded cable, vented cap, multivibrator circuit, nichrome electrode, mercury, and a container for mercury. Measurements, calibrated within 1 mbar, were tested over a range of 0.2 to 0.8 bars. The capacitance of the transducer is transformed to audio frequency, which can be transmitted through shielded cables without frequency shift or impedance loading to the output transistors. (Cassar-FRC)
W81-01271

MODELLING GROUNDWATER CONTAMINATION FROM LAND-APPLIED SWINE WASTE,
British Columbia Univ., Vancouver. Dept. of Bio-Resource Engineering.
B. R. Cappelaere, and T. H. Podmore.
Transactions of the ASAE, Vol 23, No 5, p 1147-1152, October/November, 1980. 7 Fig, 19 Ref.

Descriptors: *Farm wastes, *Nitrates, *Aquifers, Groundwater movement, Water table, Mathematical models, Water pollution sources, Leaching, Fertilizers, British Columbia, Soil contamination, Hogs.

A one-dimensional model was used to simulate water table fluctuations and nitrate distribution in order to improve waste management practices. The specific problem was a shallow, unconfined aquifer in British Columbia used as a source for residential water and for raising livestock. Liquid

swine waste was applied to a 5 hectare pasture on the upper reaches of the aquifer. The model, based on the flow and convection/dispersion equations, was used to estimate nitrate loading leached to the groundwater and nitrate concentration profiles. Observed and predicted water table fluctuations agreed closely. (Cassar-FRC)
W81-01273

A FIELD EVALUATION OF THE HASL WET-DRY DEPOSITION COLLECTOR,
Department of Energy, New York. Environmental Measurements Lab.
D. C. Bogen, S. J. Nagourney, and C. Torquato.
Water, Air, and Soil Pollution, Vol 13, No 4, p 453-458, December, 1980. 2 Fig, 3 Tab, 9 Ref.

Descriptors: *Sampling, *Rain gages, American Samoa, *Sea spray, Precipitation gages, *Chemical analysis, Sampling, Methodology, Equipment, Wet-dry deposition collector.

The efficiencies of a HASL (Health and Safety Laboratory) wet/dry deposition collector and a total collector were compared at Tutuila Island, American Samoa. At this location, wet deposition is exclusively rain; sea spray aerosol is the major source of dry deposition. Volumes of water deposited in duplicate wet/dry collectors were within 4% of the rain gauge measurements after corrections for evaporation were made. The wet and dry sides of the HASL collector picked up about 90% of Cl(-), SO4(--), Ca(++), Na(+), Mg(++), and K(+) compared with the total collector, which is continuously exposed to the atmosphere. Results for Ca(++) and K(+) were variable because of analytic uncertainties at the low concentration in the samples. These differences in collection efficiencies were not considered significant. (Cassar-FRC)
W81-01351

LARGE SCALE DEVELOPMENT OF REMOTE HOUSING IN SUBARCTIC AREAS,
R and M Consultants, Inc., Anchorage, AK.
W. A. Robertson, and R. L. Schreader.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 426-438. 4 Fig, 6 Ref.

Descriptors: *Alaska, *Terrain unit mapping, *Aerial photography, *Photogrammetry, Remote sensing, Permafrost, Septic tanks, Soil disposal fields, Permeability, Soil physical properties, Waste disposal, Sewage disposal, Terrain analysis, Geomorphology, Mapping, Topographic mapping, Surveys.

Terrain unit analysis was used to analyze 1,862 ha at Glennallen, Alaska, to aid in compliance with water and sewer regulations pertaining to the land prior to its transfer from State control to private control. Terrain unit analysis consists of identifying landforms by airphoto interpretation and defining the variations of geotechnical conditions for each landform by actual ground truth observations and borings. This method was successfully used on the Trans-Alaska Pipeline Project. For the Glennallen project, all available aerial photographs were collected and a preliminary terrain unit map was produced. Some of the area was covered by a previous engineering geologic map and this map was used for cross checking. Next, high quality 1 cm = 120 m aerial photographs were obtained for detailed photogrametric mapping. A limited amount of field truth was done to substantiate the mapping results. Three separate cases or ground types were observed from the analysis and recommendations were made as to lot size, suitability for on-site sewage disposal, and maximum recommended density. The Alaska Department of Environmental Conservation approved the mapping results and parts of the area were opened to the public in 1979. The use of terrain unit mapping rather than conventional techniques allowed substantial savings in both time and money in the development of this remote housing project. (See also W81-01381) (Seigler-IPA)
W81-01407

8. ENGINEERING WORKS

8A. Structures

STUDIES OF UTILITY CONSTRUCTION IN COLD REGIONS,
Ontario Ministry of the Environment, Toronto.
M. Fielding.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Aberta, Report No EPS 3-WP-80-5, October, 1980, p 136-139. 1 Fig, 5 Ref.

Descriptors: *Canada, *Ontario, *Utilities,*Water works, *Cold regions, Freezing, Frost heaving, Manholes, Soil temperature, Concrete pipes, Insulation, Polystyrene, Stress gauges, Muskeg, Heat of fusion, Water temperature.

On-going, problem oriented work on utility delivery in the Province of Ontario is reported. Population centers between 45 and 50 degrees North with a January design temperature range from -20 to -40C are being used. Trenching in muskeg and Precambrian rock is generally involved in utilities construction in these areas. An initial study involved temperature monitoring in the soil surrounding an insulated watermain. The watermain consisted of 30 km of 600 mm reinforced concrete pipeline buried to a cover of 1.1 m and insulated with a 50 mm by 2.5 m slab of polystyrene. Although frost penetration was greater than expected, freezing of the pipe contents did not occur probably due to the latent heat of fusion of the contents. Data from this study prompted an analysis of the theoretical aspects of pipeline freezing. Analysis results concluded that existing standard theory can be used to calculate design temperatures at any given depth in the soil and from this the residence time above which pipe contents will freeze can be determined. On-going studies include a soil temperature measuring project at Keewatin, Ontario, and an induced stress project on precast concrete manholes at Thessalon, Ontario. (See also W81-01381) (Seigler-IPA)
W81-01388

CRITICAL EVALUATION OF INSULATED SHALLOW BURIED PIPE SYSTEMS IN THE NORTHWEST TERRITORIES,
Construction for the Government of the Northwest Territories, Yellowknife Dept. of Public Works.
F. W. James.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 150-186. 44 Fig.

Descriptors: *Northwest Territories, *Canada, *Public utilities, *Cold regions, *Plastic pipes, Freezing, Insulation, Water conveyance, Manholes, Hydrants, Permafrost, Pipelines, Sanitary engineering, Cost analysis, Thawing, Freeze-thaw tests.

Experiences from the sad and expensive history of piped utility system in northern permafrost regions has lead to the design of an insulated shallow buried pipe system that appears to be a good standardized economically practical, northern pipe system. The water system has a single pipe recirculation design consisting of one or more uninterrupted loops coming from a recirculating facility and returning to that facility without branch systems. It operates as a normal gravity system. Water and sewer transmission mains are individually insulated and are placed in the same trench. The pipes are high density polyethylene covered with insulation of high density urethane. The outermost pipe cover is an extruded impermeable plastic jacket. Back up freeze protection systems include heat trace, thaw tubes, thaw wires, and bleeding. Pipes are continually joined by butt fusion. Service manholes are large enough to permit servicing inside and are placed at a maximum spacing of 100 m. The shallow buried system minimizes energy input for operation, is simple to operate and maintain, allows maximum use of short construction seasons, can be drained, has a minimum 20-year design life, minimizes on-site labor, and is economically practical. (See also W81-01381) (Seigler-IPA)
W81-01390

PRE-INSULATED HIGH DENSITY POLYETHYLENE PIPING – THE EVOLUTION OF A NORTHERN ACHIEVEMENT,
Du Pont of Canada Ltd., Mississauga (Ontario). Pipe Div.
A. D. Whyman.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 187-220. 18 Fig, 5 Ref.

Descriptors: *SCLAIRCOR, *Canada, *Cold regions, *Plastic pipes, *Public utilities, Freezing, Thawing, Plumbing, Sanitary engineering, Water supply, Sewage, Sewers, Water delivery, Water works, Insulation, Polyurethane, Polyethylene, Pipelines, Piping systems(Mechanical).

Du Pont of Canada's SCLAIRCOR pre-insulated piping system has been greatly refined and improved since its introduction in 1976 so that it is now a desirable system for utilities in northern regions. SCLAIRCOR is composed of three elements: SCLAIRPIPE high-density polyethylene pipe and fittings, factory-applied rigid polyurethane foam insulation and fittings insulation covers, and ECONOTRACE parallel-resistance heat tracing cable and accessories. An extruded polyethylene jacket is used as a cover for underground applications while a spirally formed galvanized steel or aluminum cover is used above ground. All components are manufactured in Canada and the pipe is shipped in 38 or 50 foot lengths. Sections are joined by butt fusion. By 1979 more than 200 installations had been made for a total of approximately 305,000 m. The evolution of many basic configurations and applications has lead to a moratorium on design changes and a prime concern for standardization. Du Pont also offers extended product information and aids for planning and design such as the PIPETEMP Thermal Analysis program, the HYDTRAN Hydraulic Transient Analysis, and the SESME Stress Evaluation for Marine Applications. (See also W8101381) (Seigler-IPA)
W81-01391

THE APPLICATION OF SKIN EFFECT CURRENT TRACING FOR FREEZE PROTECTION OF WATER SYSTEMS,
RICWIL, Inc., Brecksville, OH.
R. W. Tracey.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 263-287. 17 Fig, 2 Tab.

Descriptors: *Skin Effect Current Tracing, *Cold regions, *Pipelines, *Freezing, Pipes, Utilities, Water works, Heating, Water temperature, Heat transfer, Electric currents, Electrical grounding, Electrical properties, Insulation, *Heated pipelines.

Skin Effect Current Tracing (SECT), a circuit comprised of a carbon steel heat tube and an insulated, stranded copper heating cable, provides a unique, reliable method of electrically heating pipe line systems. SECT uses an AC power source to pass the heating current through the cable with the circuit being completed by the current passing through the heat tube and back to the power source. Due to the ferromagnetic properties of the heat tube and the skin effect, the maximum penetration of current density through the wall of the heating tube is only 0.9 mm. The skin effect is the concentration of the return current near the inner surface of the tube. The skin effect makes SECT electrically safe and allows the piping system to be grounded. SECT also has a reliable automatic temperature control that controls pipe temperature well within + or - 5%. Existing installations account for over 250 SECT traced lines in operation for a 15 year period. SECT heating can be adapted to a wide variety of piping systems according to region environment and functional application needs. This heating system features very efficient heating, energy savings, reliability, low mainte-

nance, and favorable operating costs. (See also W81-01381) (Seigler-IPA)
W81-01398

ELECTRIC HEAT TRACING AND ENERGY CONSERVATION FOR NORTHERN INSTALLATIONS,
Thermon Mfg. Co., San Marcos, TX.
B. C. Johnson, R. K. Pitzer, and G. Tarbutton.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980. p 288-309. 8 Fig, 11 Tab, 6 Ref.

Descriptors: *Electrical mining, *Heat tracing, *Energy conservation, *Cold regions, Electrical resistance, Electrical properties, Electrical impedence, Electrical equipment, Electrical design, Electric cables, Public utilities, Pipelines, Water works, Freezing, Monitoring, *Heated pipelines.

The conservation of energy and money for electric heat tracing of northern pipe installations requires well-sealed, economically-selected thermal insulation, a dependable control system, and a heating cable that matches the thermal requirements of the system. The selection of proper insulating material considers thermal characteristics, mechanical properties, chemical requirements, moisture resistance, health and safety, and cost. The insulation must be dry for proper operation of an electrically traced system. The two most common types of weather barriers for field installed insulation are metal jacketing and mastics. Types of heating cables available today include resistance heating cable or tapes in either series or parallel, Skin Effect Current Tracing, impedence heating, and induction heating. Resistance heating is most widely applied for freeze protection and general process temperature maintenance. Circuit controls available include mechanical controllers, electronic controllers, thermocouple sensing elements, radiation or optical pyrometers, and metallic or non-metallic thermoresistive sensory elements. Heating elements are monitored and alarmed to assure operational status. Required design consideration are listed and discussed. (See also W81-01381) (Seigler-IPA)
W81-01399

THAWING OF FROZEN WATER SERVICES,
Western Water and Sewer Supplies (1978) Ltd., Edmonton (Alberta).
R. Currey.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October 1980, p 310-313. 1 Fig.

Descriptors: *Thawing, *Freezing, *Water works, *Cold regions, *Pipes, Insulation, Water temperature, Hot water, Pipelines, Electrical equipment, Electric currents, Soil temperature, Frost protection, Public utilities.

Electrical thawing and hot water thawing are the two accepted methods of thawing frozen service lines. Despite compliance with design criteria stating that all utility service lines must be installed below the normal frost level, subsequent activities such as street grading, driveway excavation, and sidewalks can cause freeze ups due to lack of soil cover. Thawing with electricity involves passing an electrical current through the service line pipe to increase the temperature and melt the ice. Gasoline powered welders can be used to provide the electrical energy. Asbestos cement water mains with copper service lines are thawed by using 200 to 300 amps ranging from 10 to 40 volts for a few minutes. Electrical thawing must be done by qualified people due to the hazards of stray electrical currents. Hot water thawing is internal thawing done by including hot water directly into the problem area. This method is preferred over electrical thawing because all types of service lines can be thawed with the hot water probe, initial equipment costs are less, it is quicker, and less labor is required. After thawing further freeze ups can be prevented by lowering the grade of the line, increasing insulation, increasing ground cover, changing traffic patterns, or continuous bleeding. (See also W81-01381) (Seigler-IPA)
W81-01400

THERMODYNAMIC ANALYSIS OF THE WATER DISTRIBUTION SYSTEM IN INUVIK, NWT,
Associated Engineering Services Ltd., Edmonton (Alberta).
J. A. Hull.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 332-346. 5 Fig.

Descriptors: *Utilidors, *Inuvik, Northwest Territories, *Freezing, *Protection, Computer programs, Computer models, Cold regions, *Pipelines, Soil temperatures, Mathematical models, Model studies, Water works, Thermal properties, Water distribution.

HYDROTHERM, a computer program that simulates the hydraulic and thermodynamic aspects of a pipe network was used to analyze the thermal behavior of Inuvik's utilidor system. Inuvik is in an area of highly thaw sensitive permafrost, and a variety of utilidor designs with various freeze protection methods have been used in an attempt to reduce extremely high capital costs. HYDROTHERM has nine active programs run in an automatic self-generating order. The program is iterative with pressure, flows, and temperatures calculated and corrected from one iteration to the next. Heated and unheated utilidors were considered separately because their circulation and thermal effects are extremely different. Results show that freeze protection in the heated utilidors may be marginal for extended cold weather periods. Also, in these heated utilidors, freeze protection under extreme conditions is partly dependent on water demand. Unheated utilidors appear to have adequate freeze protection under present and proposed operating conditions, with the exception of one section. Results also show that the use of heat lost from heating pipes as a means of protection is inefficient and difficult to control, while forced circulation and heat addition directly at selected locations was efficient and controllable. (See also 81-01381) (Seigler-IPA)
W81-01402

WATER DISTRIBUTION PIPE NETWORKS FOR ARCTIC SETTLEMENTS,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
W. James, and M. A. Robinson.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 347-363. 1 Tab, 4 Ref.

Descriptors: *Canada, *Computer programs, *FASTPIPE, *Networks, Public utilities, Algorithms, Optimization, Data processing, Model studies, Cold regions, Mathematical models, Freezing, *Pipelines, Water distribution, Computer models, Design criteria.

The FASTPIPE computer program, which uses a variety of individually operating algorithms to aid in the design of water distribution networks, was upgraded using interactive conservational software to produce a fast, efficient, easy-to-use method for computing optimum designs for Canadian pipe distribution systems. Algorithms used in FASTPIPE include an algorithm for pressure and flow analysis, an algorithm for optimum design of pipe networks, and an algorithm for the optimum design of materials and devices for protecting utilities against freezing. The use of interactive design dialogue leads the user through a pipe distribution system design by requesting, at various stages, specific input while still allowing the user, at any point, to change the sequence. The package is comprised of two distinct separate programs, NETWORKOPTIMIZE (NETOPT), an interactive design of a cost effective network operating under steady state conditions, and ARCTIC, an interactive design of an optimal continuous or pulsed system. The package was used to design the optimal layout for the Broughton Island network and to determine the optimum power and insulation requirements for that system. The package is commercially available to dial-up terminals in most North American cities. (See also W81-01381) (Seigler-IPA)
W81-01403

8B. Hydraulics

APPROXIMATE ANALYSIS OF UNSTEADY LAMINAR FLOW,
RCA Research Center, Princeton, New Jersey.
D. Stavitsky, and E. Macagno.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY12, p 1973-1980, December, 1980. 3 Fig, 4 Ref.

Descriptors: *Mathematical models, *Pipe flow, *Water pressure, Pressure conduits, Flow resistance, Fluid friction, Movement, Fluctuations, Engineering, Model studies, Hydraulics, Variability, Reynolds number, *Laminar flow, *Unsteady flow.

Many problems have been encountered with solutions of unsteady laminar flow of incompressible fluids in circular pipes due to varying pressure differences. Lengthy and cumbersome mathematical calculations often result when the Uchida or Szymanski equations are applied to this situation. An approximate model is proposed to simplify the calculations of unsteady flow, and the method is checked for validity with exact solution models. Results showed that errors introduced by the new technique are relatively small, while time savings in calculations are large when compared to exact solution methods. The solution for any pressure variation and any conduit cross-sectional shape for which uniform flow solutions are available can be listed in terms of one simple integral. The average friction coefficient may be obtained as a function of an average Reynolds number, the oscillatory mean pressure difference ratio, and the Stokes number. The proposed mathematical model allows any oscillatory flow in a conduit to be handled as steady flow when corrections are made for the average resistive force. (Geiger-FRC)
W81-01367

8C. Hydraulic Machinery

WIND GENERATED ELECTRIC POWER FOR SANITATION SERVICES -- A CASE STUDY,
Ellerbe Alaska, Fairbanks.
M. A. Crawford, and T. J. Bergin.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 89-104. 6 Fig.

Descriptors: *Alaska, *Wind power, *Power sources, *Cold regions, *Electric power production, Water wells, Water supply, Standby power, Design data, Project post-evaluation, Pumping, Cost analysis, Sanitary engineering, Public utilities, Water works.

The utilization of wind-generated electric power, battery power storage, water storage, single point gravity delivery in the small village of Council, Alaska, indicates that wind power systems are a very viable alternative to conventional diesel generator power sources in remote Alaskan villages in windy regions. Council is approximately 50 miles east-northeast of Nome and has approximately 30 permanent residents. A well was drilled in the center of the village and electric motor-driven submersible well pump was installed. A wind generator/battery prime electrical power system was installed for the design average wind speed of 19.3 km/h with a design calm period of four days. For a calm of more than four days a standby diesel generator is activated. A 6.4 m by 3.35 m building was constructed to accomodate the water storage tanks, well space heater, battery bank, inverter wind generator control panel, standby generator, and arctic entry vestibule. A project cost of $56,711 indicates that the wind generator and associated auxiliaries have an 8.7 year payback. Two small operational problems have been corrected and the system has withstood three blizzards, an

ice storm, and winds in excess of 129 km/h. (See also W81-01381) (Seigler-IPA)
W81-01385

8D. Soil Mechanics

USE OF A GEOTHERMAL MODEL IN NORTHERN MUNICIPAL PROJECTS,
EBA Engineering Consultants Ltd., Edmonton (Alberta).
D. Kent, and C. T. Hwang.
In: Proceedings - Second Symposium on Utilities Delivery in Northern Regions, March 19-21, 1979, Edmonton, Alberta, Report No EPS 3-WP-80-5, October, 1980, p 317-331. 6 Fig, 13 Ref.

Descriptors: *Geothermal studies, *Computer models, *Cold regions, *Pipelines, Freezing, Thawing, Computer programs, Soil temperature, Mathematical models, Data processing, Model studies, Water works, Meteorological data, Thermal properties.

A computerized geothermal model was developed for design feasibility study of northern pipelines. The model predicts the thermal response of the soil to changes in the thermal environment such as those resulting from a chilled or heated pipeline, construction of a building or embankment, or an alteration of ground surface properties. The model program has a thermal conduction code with a finite element formulation of the transient heat conduction mechanism of freezing and thawing. The ground surface heat exchange code simulates the heat exchange mechanism at the ground surface using meteorological data. The model was verified against measured temperatures from a Canadian Arctic Gas Pipeline facility. Excellent agreement was observed. Steps involved in model application include the collection of site information, selection of thermal properties, model calibration, and two-dimensional analysis. Case histories are given for model use with the Dawson City, Yukon water and sewer system and the Norman Wells water tank. (See also W81-01381) (Seigler-IPA)
W81-01401

8F. Concrete

TETON DAM-FOUNDATION GROUT TESTING PROGRAM,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
R. J. Bard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-132417, Price codes: A03 in paper copy, A01 in microfiche. Report REC-ERC-79-2, December, 1979. 39 p, 29 Fig, 3 Tab, 8 Ref.

Descriptors: *Grouting, *Calcium chloride, *Dam failure, *Materials testing, Construction materials, Water-cement ratio, Dam construction, Dam foundations, Permeability, Mechanical properties, Strength of Materials, Hydration, *Teton Dam(ID).

After failure of Teton Dam in Idaho on June 5, 1976, a program was initiated to test foundation grouts similar to those used during construction of the dam. Grouts were made with the same cement, sand, bentonite, and calcium chloride used during construction, using mix proportions representative of grouts used, and mixed and cured as congruently to field conditions as possible. All mixes produced grouts exhibiting good hydration properties and good physical soundness. The inclusion of calcium chloride in grout mixes apparently did not cause formation of any compounds or substances which would be water soluble or erodible. Consideration should be given to specifying an upper limit of about 6% calcium chloride, by weight of cement, for sanded foundation grouts. Variations in the grout temperature at the end of the mixing period did not have adverse effects on grout. Although grouts tested were not impermeable, their relative permeability is low enough to preclude significant waterflow. Large amounts of bleeding, in grouts with high water to cement, and water to cement to sand ratios seem relatively inconsequential. (Moore-SRC)
W81-01237

8G. Materials

POLYESTER-RESIN ANCHOR CREEP STUDY,
Water and Power Resources Service, Denver, CO.
D. G. Miller.
Report GR-80-5, June, 1980. 16 p, 6 Fig, 3 Ref.

Descriptors: Binders, *Creep, *Rock bolts, *Materials testing, Adhesives, Loads(Forces), Bonding, Polyester resins, *Engineers estimates, Design criteria.

Mechanical rock bolt anchors have long been a weak link in obtaining full utilization of the strength of a rock bolt, and sometimes are totally unsatisfactory in certain types of rock. This research was initiated to determine the sustained and ultimate load carrying capacity of a polyester-resin type anchor. In the laboratory, a reinforcing steel rock bolt was anchored in a concrete cylinder using a polyester-resin cartridge type anchor. A load was applied to the rock bolt and anchor immediately following resin hardening and the system was monitored for load relaxation. Load data were gathered for 21 months. Early and sustained load carrying capabilities were impressive, with a load reduction of only 27% from the time of final retensioning to the end of periodically monitored readings 21 months later. The creep rate appeared to decrease as a function of both time and decreasing load. The anchorage remained in a tensioned state for the next 40 months, although the load was not monitored. After a total of 61 months the anchorage was tested to failure in a pull-out test. The strength of the resin bond exceeded that of the reinforcing steel bolt, which failed at a load of 229 kN (51,500 lbf). Resin anchors have been used on several Water and Power Resources Service Projects with great success. (Moore-SRC)
W81-01235

ST. LOUIS COUNTY STANDARDIZES PIPE AND PROCEDURES FOR RELIABILITY.
Water and Sewage Works, Vol 127, No 12, p 44-45, December, 1980. 3 Fig.

Descriptors: *Pipes, *Water conveyance, St. Louis County Water Company, Distribution systems, Joints(Connections), Metal pipes, Reliability, Specifications, Costs, Installation, Maintenance, Corrosion control.

Use of ductile iron pipe has shown many advantages in the St. Louis County Water Company system since this material was first installed 20 years ago. All standardized pipes and fittings couple with push-on gasketed joints. Pipe is palletized for easy shipment and storage. Corrosion is minimized by coating with cement and asphalt and wrapping with 8-mil polyethylene. Reinforced concrete squares are used as thrust blocks for 6 and 8 diameter pipes. The Company has a very small incidence of joint leaks, traceable to improper installation or corrosion. Ductile iron pipe can tolerate error in pipe laying procedures. Although costs vary with conditions, estimates for a 6 in iron pipe are as follows: first 400 feet, $12.68 per foot; next 600 feet, $12.24 per foot; over 1000 feet, $8.96 per foot. The cost of laying 8 in pipe adds $3.10 per foot to the figures for the 6 in pipe. Properties and costs of ductile iron and cast iron pipes are compared in a table. (Cassar-FRC)
W81-01343

8I. Fisheries Engineering

CEDAR RIVER SOCKEYE SALMON PRODUCTION, 1980,
Washington Univ., Seattle. Fisheries Research Inst.
Q. J. Stober, and A. H. Hamalainen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156655, Price codes: A04 in paper copy, A01 in microfiche. Completion Report FRI-UW-8016, September, 1980. 59 p, 17 Fig, 8 Tab, 36 Ref, 1 Append. OWRT-A-103-WASH(1), 14-34-0001-0151.

Descriptors: *Sockeye salmon, *Incubation, *Washington, *Fish diseases, *Fish harvest, Fish handling facilities, Fish management, Salmon, Aquatic animals, Aquatic life, Fish, Salmonids, Commercial fish, Marine life, Marine animals, Sport fish, Wildlife, Infection, Hatching, Fish hatcheries, Fish populations.

The 1979 Cedar River escapement of sockeye salmon was estimated at 185,300 spawners that were the progeny of the 1975 brood year that had been impacted by the maximum flood on record. River discharge during the 1979 spawning season was regulated along the critical year flow curve, due to extant drought conditions. National egg survival was probably reduced by a moderate flood in mid-December. Fry estimated to have entered Lake Washington totalled 14,900,000 (including 5,100,000 sockeye fry estimated to have survived from 9,700,000 artifically-produced fry from the Washington Department of Fisheries incubation facility). The egg-to-fry survival rate for the entire run was 4.0%. The infection rate due to hematopoetic necrosis viral disease (first detected in fry in the incubation boxes and fyke net catches simultaneously, and in all returning adults sampled) declined to low level after all fry emigrated from the enhancement facilities. The 1976 and 1978 brood years were comparable, but 1978 escapement was doubled. Egg-to-fry survival was 8.1, 4.5, and 4.0 for the 1976, 1978, and 1979 brood years, respectively. The number of pre-emergent fry has increased with enhancement production. (Zielinski-IPA)
W81-01206

EVALUATIONS OF A BYPASS SYSTEM FOR JUVENILE SALMONIDS AT LITTLE GOOSE DAM,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
J. R. Harmon, and D. L. Park.
Marine Fisheries Review, Vol 42, No 6, p 25-28, June, 1980. 2 Fig, 1 Tab, 5 Ref.

Descriptors: Dam design, Bypasses, *Chinook salmon, *Smolt, Conduits, *Dams, Fish migration, Fish behavior, Seasonal, Snake River, *Fish passages, Salmon, Fish guiding.

A new system for bypassing juvenile chinook salmon at the Little Goose Dam on the Snake River is proposed, and the existing system at Little Goose is evaluated. The orifice diameter, lighting, and placement in turbine intake slots of the test system were evaluated, along with overall system efficiency during the migration of chinook salmon and steelhead smolts in April and May of 1978. Existing six inch orifices were blocked off, and 12 inch fingerling transfer pipes with 8 to 10 inch orifices were tested. Marked fish were used to determine the efficiency of the orifices. Two orifices are needed for satisfactory passage due to varying current directions. Also, lighted orifices increase passage rates for salmon. A complete system at Little Goose would include north and south, 12 inch diameter lighted orifices in the downstream walls of the bulkhead slots. (Small-FRC)
W81-01300

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

WESTERN ENERGY AND LAND USE TEAM PUBLICATIONS: A BIBLIOGRAPHY WITH ABSTRACTS.
Fish and Wildlife Service, Fort Collins, CO. Western Energy and Land Use Team.
Report W/COAL-80/W28, October, 1980. 55 p.

Descriptors: *Bibliographies, *Land use, *Wildlife, *Water utilization, Environment, Abstracts, Documentation, Water resources, Energy resources.

This bibliography contains an annotated list of Biological Service Program publications produced or sponsored by the Western Energy and Land Use Team and included in the FWS/OBS Publication Series. The Biological Services Program is responsible for the development and dissemination of information pertaining to fish and wildlife resources and habitats, while the Western Energy and Land Use Team is the Service's major technical research and development organization for the study of Western land and water use. Publications are listed in the order of their FWS/OBS numbers. Each bibliographic entry contains ordering information and a brief abstract. There are five separate indices: author index, corporate author index, funding source index, geographic index, and keyword subject index. The bibliography includes 87 publications.
W81-01227

SUMMARIES OF RIPARIAN AND STREAM ALTERATION STUDIES COMPLETED BY THE EASTERN ENERGY AND LAND USE TEAM.
Fish and Wildlife Service, Kearneysville, WV. Eastern Energy and Land Use Team.
Report, July, 1980. 44 p.

Descriptors: *Wildlife, *Bibliographies, *Stream improvement, Environmental effects, Abstracts, Channel improvement, Flood control, Fish, Vegetation, Bank stabilization, Water resources development.

The Fish and Wildlife Service began funding stream alteration and riparian studies in FY'73. This bibliography provides abstracts or executive summaries for studies completed by the Eastern Energy and Land Use Team through 1980 pertaining to the impact of stream channelization, bank stabilization, water level changes, gravel removal, and water resources development on vegetation, fish and wildlife. Thirty-four publications are included in this bibliography. (Moore-SRC)
W81-01228

10D. Specialized Information Center Services

TAPPING DRINKING WATER DATA: A PROTOTYPE SYSTEM,
Michigan Univ., Ann Arbor.
R. A. Deininger, R. P. Thomas, and R. M. Clark.
Journal of the American Water Works Association, Vol 72, No 11, Part 1, p 600-603, November, 1980. 12 Fig, 4 Ref.

Descriptors: *Water quality, *Potable water, *Data storage and retrieval, *Michigan University, Public utilities, Data collections, Documentation.

A prototype data analysis and management system developed by the University of Michigan and the EPA Drinking Water Research Division enables a user to search for data on the water quality of U.S. utilities. The data base, current to 1977, presently contains information on 45 water quality parameters in 1000 public water supplies. The inquiry language, designed for user convenience, resembles English and is used in an interactive, conversational form. Typical questions which may be answered by the system are as follows: What percentage of water supplies contain mercury from 0 to .002 mg/liter. How many New Jersey water supplies exceed the standard for nitrate, 10 mg/liter. How many suppliers have information on organics. (Cassar-FRC)
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ACIDIC WATER
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W81-01310 5E

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W81-01347 5D

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W81-01358 5D

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W81-01297 5D

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W81-01348 5B

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W81-01312 5E

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W81-01228 10C

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VOLUME 14, NUMBER 9
MAY 1, 1981

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SELECTED WATER RESOURCES ABSTRACTS

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PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
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Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

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Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

CONTROLLING THE RATE OF ACID LOSS FROM STRIP MINE SPOIL,
Science and Education Administration, University Park., PA. Northeast Watershed Research Center.
For primary bibliographic entry see Field 5B.
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2C. Snow, Ice, and Frost

COMMENT ON 'EFFECTS OF CHANNEL ENLARGEMENT BY RIVER ICE PROCESSES ON BANKFULL DISCHARGE IN ALBERTA, CANADA' BY D. G. SMITH,
Kellerhals Engineering Services, Heriot Bay (British Columbia).
R. Kellerhals, and M. Church.
Water Resources Research, Vol 16, No 6, p 1131-1134, December, 1980. 2 Fig, 19 Ref.

Descriptors: *Ice breakup, *River flow, *Scour, Stream erosion, Flood recurrence interval, Alberta, *Canada, Ice jams, Streamflow, Channels, Banks, Erosion, Flood flow, Flood plains.

The author challenges Smith's (1979) explanation (channel scour due to ice jams and ice transport at breakup enlarges river channels) for the unusually long time observed for Albertan rivers to return to bankfull flow. Although the ice scour is not dismissed entirely, three other explanations are suggested: recent entrenchment of some major rivers' return periods may be shorter than Smith's indication, and small streams ice completely to the bottom, causing flooding upon breakup. (Cassar-FRC)
W81-01516

2D. Evaporation and Transpiration

NIGHTTIME, WET CANOPY EVAPORATION RATES AND THE WATER BALANCE OF AN EVERGREEN MIXED FOREST,
Forest Research Inst., Christchurch (New Zealand).
A. J. Pearce, L. K. Rowe, and J. B. Stewart.
Water Resources Research, Vol 16, No 5, p 955-959, October, 1980. 1 Fig, 15 Ref.

Descriptors: *Evaporation, *Interception, Diurnal, Hydrologic cycle, Energy transfer, Water balance, Canopy, Mathematical studies, Regression analysis, Rainfall, Transpiration, Radiation, Stemflow.

The nighttime evaporation rates from the wet canopy of an evergreen mixed forest were investigated to better understand the water balance and diurnal energy relationships. The study site, located in the northwest sector of South Island, New Zealand, averaged 2600 mm of rainfall per year, and 50% of this occurred at night. A regression of interception loss on gross rainfall for 35 storms occurring between 7 pm and 7 am LT showed that the average nighttime evaporation rate of water intercepted on the forest canopy was 0.37 mm/hour. The same rate was also calculated for both daytime and nighttime rainfall in 1975-1976. This similarity between daytime and nighttime evaporation rates suggested that evaporation from the wet canopy is driven by advected energy instead of radiation. A net interception loss of 81-84% of gross interception was calculated from the diurnal rainfall distribution and nighttime evaporation rate. This value was greater than the net losses measured in other investigations where losses at night were not considered separately but were estimated in conjunction with losses occurring during the day. Nighttime interception losses were about 30% of total evaporation, 40-50% of total gross interception, and 50-60% of the total net interception. (Geiger-FRC)
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2E. Streamflow and Runoff

VULNERABILITY OF WATER SUPPLY SYSTEMS TO DROUGHTS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 6B.
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FLUVIAL GEOLOGY AND ARCHAEOLOGY OF THE HOUSATONIC RIVER VALLEY IN NORTHWESTERN CONNECTICUT,
Wesleyan Univ., Middletown, CT. Dept. of Earth and Environmental Sciences.
For primary bibliographic entry see Field 2J.
W81-01496

COMMENT ON 'EFFECTS OF CHANNEL ENLARGEMENT BY RIVER ICE PROCESSES ON BANKFULL DISCHARGE IN ALBERTA, CANADA' BY D. G. SMITH,
Kellerhals Engineering Services, Heriot Bay (British Columbia).
For primary bibliographic entry see Field 2C.
W81-01516

COMMENT ON 'DRAINAGE NETWORK POWER' BY K. J. GREGORY, AND REPLY BY K. J. GREGORY,
Sheffield Univ. (England). Dept. of Geography.
A. D. Knighton.
Water Resources Research, Vol 16, No 6, p 1128-1129, December, 1980. 1 Tab, 6 Ref.

Descriptors: *Drainage, *Streamflow, Flow measurement, Hydrology, Channels, Potential flow, *Flow characteristics, Basins, Topography, Forecasting, Evaluation.

Gregory stated in a 1979 paper that flow characteristics in a drainage network can be estimated by using the index of estimated channel volume to total relief of the basin, and that this index expresses the potential energy available in the stream network of a drainage basin. This assertion is challenged because the structure of the network is ignored and only bankfull stage is considered. In addition, it is claimed that the parameters are not easily measured and that results would be a poor estimate of flow characteristics. Gregory replies to these criticisms with further clarifications and claims that although the proposed index is not perfect, it is an improvement on existing knowledge of the relation between channel length and channel capacity. (Cassar-FRC)
W81-01517

DISTRIBUTION-FREE METHODS FOR ESTIMATING FLOOD AND STREAMFLOW EXCEEDANCE PROBABILITIES BY CORRELATION,
Institute of Hydrology, Wallingford (England).
D. M. Cooper, and R. T. Clarke.
Water Resources Research, Vol 16, No 6, p 1121-1127, December, 1980. 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Flood forecasting, *Streamflow forecasting, *Peak discharge, *Correlation analysis, Annual flood, River forecasting, Probability, Mathematical studies, Hydrologic data, Rainfall, Flood profiles, Flood plains, Flood frequency, Estimating, Planning, Thames River(UK).

A distribution-free method is proposed for inferring probabilistic properties of a variable y (such as an annual flood in a given year or total runoff from a basin in a year) from longer records of another variable x which is related to y. Examples of x variables are annual flood measured in a neighboring basin and total mean areal precipitation in the same period. Although this method is not applicable to estimating floods of very large return periods, such as for spillway design, it should be useful in estimating floods on a shorter return period, for example, culvert design or planning land use in flood plains. As an illustration, 40 years of January streamflow and 80 years of precipitation records for the River Thames at Eddington produced close to the same estimates as those obtained from 80 years' records of both streamflow and precipitation. (Cassar-FRC)
W81-01519

SEASONAL RUNOFF VOLUMES CONDITIONED ON FORECASTED TOTAL RUNOFF VOLUME,
Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering.
K. Hoshi, and S. J. Burges.
Water Resources Research, Vol 16, No 6, p 1079-1084, December, 1980. 2 Fig, 4 Tab, 19 Ref.

Descriptors: *Snowmelt, *Runoff forecasting, Model studies, Forecasting, Streamflow forecasting, Snowpacks, Mathematical models, *Cascade Mountains(WA), Cedar River(WA), Washington, Estimating, Melt water, Melting, Glaciohydrology.

Total snowmelt runoff from a snowpack may be forecast accurately for a 6 month period. This paper describes a relatively simple and complete mathematical model which was used to divide the total forecast into monthly stream flow estimates (March - August) of the Cedar River, Washington, located in the Cascade Range. The unconditional distribution of total runoff volume for the melt season and the unconditional flow in each period within the melt season are approximated using three-parameter log normal distributions (LN3). Conditional means, skew coefficients, and covariance between periods are calculated. Uniform transformation methodology is necessary to estiamte quantiles in a multivariate Gaussian domain. These quantiles are then inversely transformed to yield flow quantities. (Cassar-FRC)
W81-01557

HYDROLOGIC REGRESSION WITH WEIGHTED LEAST SQUARES,
Geological Survey, Reston, VA.
G. D. Tasker.
Water Resources Research, Vol 16, No 6, p 1107-1113, December, 1980. 3 Tab, 10 Ref.

Descriptors: *Hydrology, *Streamflow, *Regression analysis, Peak discharge, Time series analysis, Mathematical studies, Model studies, Basins, Drainage area, Equations, Least squares method, *Flow characteristics.

Weighted least squares regression was found more accurate than ordinary least squares regression in a model simulation to calculate streamflow characteristics from basin characteristics for times and places where gaging data is lacking. The weighting function assumes the dependent variable to be a T-year peak discharge estimated by fitting the common logarithm of the observed annual peak discharge to a Pearson type 3 distribution. Although the model simulated a 50-year peak discharge, weighted least squares regression would be expected to have a greater advantage over ordinary least squares for a 100-year peak discharge. (Cassar-FRC)
W81-01558

ECOLOGICAL STUDIES ON THE SUDANESE NILE SYSTEM,
Gezira Univ., Wad Medani (Sudan).
M. E. M. Beshir, and A. I. El-Moghraby.
Water Supply and Management, Vol 4, No 1/2, p 25-28, 1980. 1 Tab, 10 Ref.

Descriptors: *River flow, *Sedimentation rates, *Ecological distribution, Dominant organisms, River basins, Silts, Limnology, Hydrologic aspects, Vegetation, *Nile River.

Ecological studies on the Sudanese Nile River system are reviewed, beginning with the works of mid-eighteenth century explorers and including the modern works of H. E. Hurst and others. Over half of the Nile's length lies in the Sudan, and counting tributaries, 6000 km of river are available for study. The first phase of studies documented the various hydrobiological aspects of the river, including limnology, water chemistry, fish, and vegetation. The second phase is purely ecological

and was prompted by the need to accumulate accurate data during a time of rapid development. Current research projects include studies of the swamps, flood plains, and toich areas. Investigations of the limit and distribution of aquatic plants and studies of the White Nile north of Malakal are also ongoing. The White Nile studies hope to determine the seasonal sediment transport and deposition, evaporation losses, spread of aquatic weeds, and the distribution of fish, phytoplankton, and zooplankton. (Small-FRC)
W81-01563

2F. Groundwater

MODELING GROUNDWATER FLOW OVER SLOPING BEDS,
New South Wales Univ., Kensington (Australia). Dept. of Civil Engineering.
T. G. Chapman.
Water Resources Research, Vol 16, No 6, p 1114-1118, December, 1980. 7 Fig, 1 Tab, 23 Ref.

Descriptors: *Groundwater movement, *Dupuit-Forchheimer theory, *Slopes, Hydraulic gradient, Flow, Subsurface flow, Uniform flow, *Model studies, Mathematical models.

The Dupuit-Forchheimer approach to problems in unconfined groundwater flow over a sloping bed assumes that stream lines are horizontal for small inclinations of the free surface and that the hydraulic gradient is equal to the slope of the free surface, not varying with depth. A simpler expression for numerical modeling, using horizontal and vertical axes, is developed for slope angles up to 30 degrees. Testing on two situations, uniform recharge to ditches on a sloping bed and steady flow through a dam with vertical faces, shows good results using the extended Dupuit-Forchheimer equation. Comparisons of the standard versus the extended equation show that the standard approach is satisfactory for slopes up to 10 degrees where the flow is essentially horizontal. The extended assumptions are more accurate at larger angles and when the free surface and bed level contours have similar patterns. (Cassar-FRC)
W81-01518

A SEMIANALYTICAL SOLUTION FOR PARTIAL PENETRATION IN TWO-LAYER AQUIFERS,
Pahlavi Univ., Shiraz (Iran).
I. Javandel, and P. A. Witherspoon.
Water Resources Research, Vol 16, No 6, p 1099-1106, December, 1980. 12 Fig, 1 Tab, 26 Ref.

Descriptors: *Aquifer testing, *Drawdown, *Flow measurement, Laplaces equation, Water wells, Wells, Aquifers, Groundwater movement, Pumping tests, Permeability, Porous media, Recharge, Subsurface waters, Natural recharge, Model studies, Mathematical models.

A semianalytical solution is presented for the problem of drawdown distribution in a 2-layer aquifer (the lower layer is very thick relative to the top layer) drained by a well which penetrates only the top layer. Numerical inversion of the Laplace transformation was applied to several practical cases: (1) the depth of penetration of the well equals the total thickness of the top layer and the permeability of the lower layer vanishes, (2) the permeability of the lower layer is zero, (3) the flow properties of both layers are identical, (4) the pumping well penetrates all the way through the top aquifer. In short intervals of time, drawdown in the pumped layer resembles the case of partial penetration in a single layer with the same properties. The effects of partial penetration disappear as distance exceeds 1.5 times the thickness of the pumped layer (single-layer aquifer). (Cassar-FRC)
W81-01555

2G. Water In Soils

FINITE ELEMENT ANALYSIS OF SOLUTE TRANSPORT UNDER HYSTERETIC UNSATURATED FLOW CONDITIONS,
National Hydrology Research Inst., Ottawa (Ontario).
J. F. Pickens, and R. W. Gillham.
Water Resources Research, Vol 16, No 6, p 1071-1078, December, 1980. 8 Fig, 1 Tab, 36 Ref.

Descriptors: *Hysteresis, *Solutes, Model studies, *Soil water movement, Hydrologic properties, Flow, Unsaturated flow, Saturated flow, Pressure head, Soil moisture, Time lag, Hydraulic properties, *Finite element analysis.

A model for the two-dimensional simulation of the transient movement of water and solutes in saturated-unsaturated soils was formulated by incorporating the Gillham representation of a hysteretic water content-pressure head relation into the nonhysteretic finite element model of unsaturated-unsaturated solute transport described by Pickens. The flow portion of the model agreed with results reported by Gillham, and the solute transport portion compared well with Pickens' analytical solution results. The model was applied to a hypothetical case involving the one-dimensional transport of a slug of water containing a nonreactive tracer during an infiltration-redistribution sequence in a vertical column of sand. Simulations were conducted using hysteretic and nonhysteretic properties given by either the main drying or the main wetting curve. The effect of including or neglecting hysteresis was greatest in the pressure head and water content profiles and of minor importance in the concentration profiles. The differences in hysteretic and nonhysteretic concentration profiles were not large and, for practical problems, are probably within the limits of uncertainty associated with the measurement of soil parameters. (Cassar-FRC)
W81-01556

2H. Lakes

INVESTIGATIONS OF WALKER LAKE, NEVADA: DYNAMIC ECOLOGICAL RELATIONSHIPS,
Nevada Univ. Systems, Reno. Desert Research Inst.
D. L. Koch, J. J. Cooper, E. L. Lider, R. L. Jacobson, and R. J. Spencer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-160970, Price codes: A10 in paper copy, A01 in microfiche. Publication No 50010, 1979. 191 p, 45 Fig, 37 Tab, 128 Ref. OWRT-C-6158(No 5236)(2) and C-7180 (No 6216)(2), 14-34-0001-5236, 6216.

Descriptors: *Ecosystems, *Water quality, *Aquatic environment, Food chains, Salmonids, Saline water, Aquatic microorganisms, Benthos, *Lakes, Algae, Cyanophyto, Hypolimnion, Environmental effects, Fish, Zooplankton, Nevada, Walker Lake(NV).

Water quality conditions of Walker Lake were found to be fairly homogeneous. Upstream diversions have resulted in a deficit water balance of the lake of 1 - 1.25 m per year since the turn of the century and a current level of 10,700 mg/l of T.D.S. The blue-green algae, Nodularia spumigena, was dominant over other algal species. A large buildup of sinking organic matter results in large oxygen demands in the hypolimnion and has become limiting to other biological populations. The benthos communities have become limited to a narrow littoral zone which limit the availability of food supplies for the Lahontan cutthroat trout juveniles. The zooplankton community is limited to three species with Diaptomus sicilis dominating. The trout population, which has been maintained through hatchery stocking programs, experience several limiting conditions; while the dominant fish species, tui chub, were found to be reproducing successfully and are quite adaptable. They form the major source of food for the adult Lahontan cutthroat trout in the lake. Exotic fish species bioassays indicated that none were able to survive 100% Walker Lake water.
W81-01426

NUTRIENT RUN-OFF FROM THE CATCHMENT AREA TO A SMALL LAKE WITH NO EFFLUENT,
Instytut Gleboznawstwa i Chemii Rolnej, Lublin (Poland).
For primary bibliographic entry see Field 5C.
W81-01553

A MODEL OF THE MEAN FIELD DISTRIBUTION OF A DISSOLVED SUBSTANCE WITHIN THE RIVERINE LAYER OF A FJORD LAKE,
National Water Research Inst., Burlington (Ontario).
P. F. Hamblin, and E. C. Carmack.
Water Resources Research, Vol 16, No 6, p 1094-1098, December, 1980. 6 Fig, 11 Ref.

Descriptors: *Fjords, *Lakes, *Mixing, Diffusion, Kootenay Lake(BC), Duncan River(BC), Kootenay River(BC), *British Columbia, Inflow, Path of pollutants, Rivers, Canada, Water pollution, Dispersion, Diffusivity.

The time-averaged distribution of a dissolved substance in a fjord system was determined for Kootenay Lake in British Columbia. This lake, 100 km x 4 km x 150 meters deep, is fed by two rivers entering at 180 degrees. Using advection-diffusion equations, a horizontal dispersion coefficient of 300 square meters per second was deduced by matching the predictions to the horizontal distribution of vertically averaged conductivity over the riverine layer. A vertical turbulent diffusivity of 0.000005 square meters per second was inferred for the riverine layer. Limits of the model were as follows: negligible tidal and wind influence, same temperature and salinity of incoming rivers, extension of riverine layer across the width of the fjord. (Cassar-FRC)
W81-01554

ECOLOGICAL STUDIES ON THE SUDANESE NILE SYSTEM,
Gezira Univ., Wad Medani (Sudan).
For primary bibliographic entry see Field 2E.
W81-01563

ECOLOGICAL ASPECTS OF LAKE NASSER-NUBIA,
B. Entz.
Water Supply and Management, Vol 4, No 1/2, p 67-72, 1980. 2 Fig, 1 Tab, 6 Ref.

Descriptors: *Reservoirs, *Succession, *Reservoir stages, Dominant organisms, Diptera, Insects, Lake stages, *Ecology, Vegetation establishment, Fish, *Nile River.

Succession of animal and plant communities during the first 10 years' existence of two manmade lakes, Lake Nasser and Lake Nubia, is discussed. The development and decline of chironomid swarms is compared to similar phenomena observed on other manmade lakes. Their feeding habits and their role as food for fish, toads, spiders, and other insects indicated that they played an important role as food organisms for many animals and insects. About the time the chironomid swarms diminished, large numbers of water bugs (corixids) became common. Fish in the reservoir seemed to cause the eventual disappearance of the bugs. The succession of under water plants was: algal epitecton, Chara fields, submerged macrophytes. Succession in lake shore vegetation was: Glinus lotoides and other weeds, desert plants, Tamarix nicotica, and the reappearance of river grass. Plants and animals were often the types found in the original river, and Nile flooding caused the re-introduction of several species. The possible role of the microclimate in limiting the dispersion of organisms in the two lakes is discussed. (Small-FRC)
W81-01564

THE WATER BUDGET OF LAKE QARUN AND ITS PHYSICO-CHEMICAL CHARACTERISTICS,
Economics, Statistics, and Cooperatives Services, Broomall, PA.

H. M. Bishai, and S. Y. Kirollus.
Water Supply and Management, Vol 4, No 1/2, p 93-97, 1980. 1 Fig, 1 Tab, 13 Ref.

Descriptors: *Water levels, *Reservoir stages, *Salinity, Brackish water, Reservoirs, Agricultural chemicals, Salts, Irrigation water, Nile River, *Egypt, Lake Qarun(Egypt), *Hydrologic budget.

The changing water level and the changing physico-chemical characteristics of Lake Qarun, Egypt, were investigated. Over the past 20 years the fresh water fauna of the lake have disappeared, and it is now a brackish lake with a maximum chlorosity of 19.97 g/liter. The average depth of the lake is 4 m, with a range of 2 to 8 m. Eighty-six percent of the total water budget of the lake comes from irrigation water drainage. During 1976, the lake area was 240.3 sq km and the average water level was -43.705 m below sea level. Chlorosity levels have changed over the years; Lucas measured 5.6 g/liter in 1906, Gorgy measured 13.87-16.1 g/liter in 1950-51, and Bishai and Kirollus measured 19.97 g/liter in 1978. Oxygen content ranges from 4.1 to 6.2 ml/liter, and transparency ranges from 450 cm to 705 cm. (Small-FRC)
W81-01565

PHYSICO-CHEMICAL CONDITIONS, FAUNA AND FLORA OF LAKE MANZALA, EGYPT,
Alexandria Inst. of Oceanography and Fisheries (Egypt).
A. H. Shaheen, and S. F. Yousef.
Water Supply and Management, Vol 4, No 1/2, p 103-113, 1980. 1 fig, 5 Tab, 14 Ref.

Descriptors: *Fish, *Lakes, *Water chemistry, Water analysis, Benthic fauna, Water quality, Dominant organisms, Salinity, Zooplankton, Algae, Nile River, *Egypt, *Manzala Lake(Egypt).

Because of its importance in the fisheries industry, Manzala Lake, Egypt, was studied to determine the physico-chemical conditions of the lake and its fauna and flora. Special attention was given to the effect of the cessation of the Nile flood. Oxygen content is high in the lake throughout the year. No differences were noticed in the chlorosity of the lake after the cessation of flood waters, primarily because excess drainage water has flowed into the lake. Slight lowering of chlorosity was recorded in 1967, which was attributed to the non-excavation of the sea-lake connections. The lake contributes 30% of the total fish yield for Egypt. Tilapia species fish are most abundant, followed by mullets. Zooplankton is comprised of fresh-water rotifers and cladocera and marine neritic copepods. Salinity of the water seems to control their occurrence. The algal flora of the lake is poor, with only a few of the halophytic type. A few benthonic genera and the planktonic genus Globigerina make up the foraminiferal content of the lake. (Small-FRC)
W81-01567

STUDIES ON THE CHANGES OF SOME ECOLOGICAL FACTORS AFFECTING FISH LIFE IN LAKE QARUN, FAIYUM, EGYPT,
Faculty of Science, Sohag (Egypt). Dept. of Zoology.
F. A. Boraey.
Water Supply and Management, Vol 4, No 1/2, p 99-102, 1980. 3 Tab, 7 Ref.

Descriptors: *Salinity, *Fish, *Lake stages, Marine fish, Evaporation, Irrigation water, Salts, Agricultural chemicals, Nile River, Environmental effects, Ecosystems, Ecology, Salt tolerance, *Egypt, *Lake Qarun(Egypt).

The increased salinity of Lake Qarun was investigated. Lake Qarun is located in the Faiyum Depression in the western desert of Egypt. Salinity levels in the lake have been increasing due to agricultural drainage, high summer evaporation, and low rainfall in the area. Presently the lake has the salinity level of the Mediterranean, 36-38%, and the percentage compositon of the salt is 64.97 NaCl, 16.77 MgSO4, 11.76 Na2SO4, and 3.35 CaSO4. The salinity of the lake is increasing at a rate of 0.5-0.8 g/liter annually. Salt-tolerant fish introduced into the lake will not be able to tolerate higher salt levels. Thus, the rate of increase of salinity of the lake must be decreased by salt extraction, or new fish must be introduced from the Red Sea which has a higher salt level. Fresh water fish have completely disappeared from the lake and unless further action is taken, all economically important fish will disappear from the lake. (Small-FRC)
W81-01568

IDENTIFICATION OF A DYNAMIC LAKE MODEL BY THE GROUP METHOD OF DATA HANDLING: AN APPLICATION TO LAKE ONTARIO,
Canada Centre for Inland Waters, Burlington (Ontario).
H. Tamura, and E. Halfon.
Ecological Modelling, Vol 11, No 2, p 81-100, November, 1980. 7 Fig, 4 Tab, 23 Ref.

Descriptors: *Mathematical models, *Water quality, *Phosphorus, *Lake Ontario, Lakes, Water temperature, Water pollution effects, Forecasting.

A revised algorithm of the group method of data handling was used to model and identify water quality dynamics in Lake Ontario. The variables were CHLA, volume-averaged over the top 20 m, and SRP in three layers: 0-20 m, 20-40 m, and from 40 m to the bottom. Inputs were the average quarterly temperatures for each layer as observed over ten years, and total phosphorus loadings. The simulations represented the data used quite well and also described the possible behavior of Lake Ontario when subjected to different possible loading regimes. Two kinds of models are presented: recursive and iterative. They were used to simulate long-term predictions for three different rates of phosphorus loadings. Models using the group method of data handling can be used to develop lake models at low costs in manpower and computer time. (Small-FRC)
W81-01578

FIELD INVESTIGATIONS AND MODEL SIMULATION OF THE DYNAMICS OF ZOOPLANKTON POPULATIONS IN FRESH WATERS,
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
W. Horn, and J. Benndorf.
Internationale Revue der Gesamten Hydrobiologie, Vol 65, No 2, p 209-222, 1980. 14 Fig, 11 Ref.

Descriptors: *Mathematical models, *Zooplankton, *Reservoirs, Productivity, *Aquatic populations, Simulations, Daphnia, Growth rates, Fecundity, Mortality.

The main parameters characterizing the dynamics of a zooplankton population in fresh waters were investigated through field tests at the Saidenbach reservoir and by means of an ecological model. Productivity of the population of Daphnia hyalina was determined using a graphic method, a numerical method which disregarded continuous change in weight increase, and an expontential model. Field investigations showed that figures characterizing biomass and net growth performance alone did not give an adequate insight into the dynamics of the zooplankton population. It was also necessary to determine gross performance. Overall, the results of field investigations and the modelling results were in good agreement. The net growth rate of Daphnia hyalina was 0.1-0.2/d at the beginning of their mass development and later took on usually negative values between 0.02 and 0.1/d. The birth rate (gross growth rate) fluctuated roughly between 0.03 and 0.1/d. High mortality rates of about 0.1/d were encountered mainly during the summer. (Small-FRC)
W81-01591

INFLUENCE OF HYDROLOGICAL FACTORS ON THE SEASONAL ABUNDANCE OF PHYTOPLANKTON IN KINJHAR LAKE, PAKISTAN,
Karachi Univ. (Pakistan). Dept. of Zoology.
S. Nazneen.
Internationale Revue der Gesamten Hydrobiologie, Vol 65, No 2, p 269-282, 1980. 5 Fig, 1 Tab, 40 Ref.

Descriptors: *Phytoplankton, *Seasonal, *Artificial lakes, Light, Temperature, Effects, Eutrophication, Phosphorus, Nitrogen, Winds, Fish, *Pakistan, Kinjhar Lake(Pakistan).

The seasonal distribution of phytoplankton in Kinjhar Lake, an artifical lake located 120 km north of Karachi, Pakistan, was investigated with emphasis on the influence of hydrological factors. The abundance of phytoplankton especially Microcystis aeruginosa, generally followed seasonal changes in light and temperature. Highest atmospheric and water temperatures were observed in May and June; minimums occurred in January. Kinjhar Lake is highly eutrophic, and nutrients were generally present in high levels throughout most of the year. During short periods when they were in short supply, phosphorus and nitrogen were limiting factors for phytoplankton. Oxygen and carbon dioxide supply in the water was uninterrupted and adequate because of continuous movement of the water due to wind. Kinjhar Lake supplies water to the population of Karachi, and it is hoped that a sufficient fish population for fishing can be developed in the lake. This study determined that phytoplankton to feed fish is available throughout most of the year, except in times of unusually low nutrient load. (Small-FRC)
W81-01593

THE ROLE OF PREDATION IN CAUSING MAJOR CHANGES IN THE LIMNOLOGY OF A HYPER-EUTROPHIC LAKE,
University of East Anglia, Norwich (England). School of Environmental Sciences.
R. T. Leah, B. Moss, and D. E. Forrest.
Internationale Revue der Gesamten Hydrobiologie, Vol 65, No 2, p 223-247, 1980. 8 Fig, 2 Tab, 41 Ref.

Descriptors: *Predation, *Fish, *Eutrophication, Zooplankton, Phytoplankton, Effects, *Limnology, Distribution patterns, Aquatic populations, Artificial lakes, *United Kingdom.

The role of predation in causing major changes in the limnology of a hyper-eutrophic lake was investigated in a shallow man-made lake divided into two basins by an earth dam. Fertile river water fed both basins, and the water chemistry of the two basins was very similar. Initially, both areas had turbid water with heavy phytoplankton crops, cyclopoid copepods and rotifers in the zooplankton, a benthic animal community of chironomids and oligochaetes which was not diverse, and virtually no submerged or floating macrophytes. Later, the area which was more isolated from river water had clear water. Phytoplankton was sparse, and zooplankton was dominated by Cladocera. Submerged and floating macrophytes were abundant, and a relatively diverse benthic fauna developed. These changes were attributed to a large reduction in the fish population of the isolated basin due to predation by cormorants. This led to decreased fish predation on zooplankton and an increase in larger, efficiently grazing Cladocera. Reduction of fish numbers may not give the same result when the water is not flushed regularly as it was in this case. (Small-FRC)
W81-01594

ON THE MECHANISM REDUCING THE PHOSPHATE CONCENTRATION IN THE WATER OF LAKE BALATON,
Research Inst. for Water Resources Development, Budapest (Hungary). Inst. for Water Quality Control.
For primary bibliographic entry see Field 5C.
W81-01597

A LIMNOLOGICAL RECONNAISSANCE OF THE LOUGH ERNE SYSTEM, IRELAND,
Ministry of Agriculture, Antrim (Northern Ireland). Freshwater Biological Investigation Unit.
C. E. Gibson, R. H. Foy, and A. G. Fitzsimons.

Internationale Revue der Gesamten Hydrobiologie, Vol 65, No 1, p 49-84, 1980. 22 Fig, 9 Tab, 24 Ref.

Descriptors: *Erne Lake(Ireland), *Lakes, *Limnology, Zooplankton, Phytoplankton, *Eutrophication, *Ireland, Algae, Chlorophyll, Aquatic life, Nutrients, Phosphates, Phosphorus compounds, Nitrates, Rotifers, Crustaceans, Copepods.

The eutrophic Erne Lake system was surveyed to document nutrient budgets, physical factors, phytoplankton, and zooplankton. The two lakes are interconnected by a channel. The upper lake is shallow with deep local areas; the lower is deep in the center and shallow near the numerous islands. Phosphorus loading in the upper lake was heavy, being related to the heavier population density in the basin. The total nitrogen to total phosphorus ratio varied widely throughout the year, rarely staying in the 'ideal' range between 20:1 and 10:1. Water temperatures, levels, and coloration are described. Phytoplankton populations in the upper lake are similar throughout, but the lower lake's population varies quantitatively and qualitatively from place to place according to depth differences. This relation between algae growth and depth was seen in a chlorophyll-a fluorometric map of the lower lake's surface. Species composition of zooplankton was similar throughout both lakes and exhibited seasonal variations. (Cassar-FRC)
W81-01598

AMMONIA MINERALIZATION AND CYCLING IN SHAGAWA LAKE, MINNESOTA,
Oklahoma State Univ., Stillwater. School of Biological Sciences.
D. Toetz, and B. Cole.
Archiv fur Hydrobiologie, Vol 88, No 1, p 9-23, February, 1980. 1 Fig, 8 Tab, 35 Ref.

Descriptors: *Cycling nutrients, *Ammonia, *Lakes, Euphotic zone, Eutrophication, Nitrate, Tracers, Nitrogen, Nutrients, Phosphorus, Phytoplankton, Streamflow, Precipitation, Sewage effluents, Path of pollutants, Minnesota, *Shagawa Lake(MN).

The rates of ammonia mineralization in Shagawa Lake, Minnesota, were measured by an isotope dilution method with labeled ammonium ion as tracer. Results were compared to uptake rates of nitrate and ammonia, rates of N2 fixation, and changes in ammonia concentration in the euphotic zone due to streamflow, precipitation and sewage discharge. In 1975, rates of ammonia mineralization ranged from 93 to 412 micrograms ammonia-N/liter/day. Turnover times for particulate nitrogen (PN) and ammonia pools were 0.89 and 0.21 days, respectively. The highest ammonia mineralization rates were observed after algal blooms. Total uptake was always less than mineralization, and indicated a turnover for the PN pool of 4-5 days in June and July and 18-53 days in late July and August. During early summer when algal biomass was low and photosynthesis rates were high, total uptake was highest, and 2-90% was due to N2 fixation. The ammonia input by sewage effluent was 16-150% of the ammonia uptake rate. Ammonia mineralization rates in August were assumed to be adequate to meet phytoplankton nitrogen demands. (Geiger-FRC)
W81-01609

2J. Erosion and Sedimentation

SEDIMENT LOADS FROM HEADWATERS OF THE EAST-CENTRAL SIERRA WATERSHEDS,
Nevada Univ. System, Reno. Water Resources Center.
J. A. Nadolski, J. C. Brown, and C. M. Skau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-160988, Price codes: A03 in paper copy, A01 in microfiche. Publication No 43009, 1980. 21 p, 4 Fig, 5 Tab, 34 Ref. OWRT-A-078-NEV(1) and A-088-NEV(1), 14-34-0001-7060, 9030.

Descriptors: *Sediment load, *Bed load, *Suspended load, *Forest watersheds, Forecasting, Headwaters, Runoff, Snowmelt, *Sierra Nevada, Truckee River, Carson River, Walker River.

Bedload and suspended sediments were measured for 14 forested watersheds in east-central Sierra Nevada. These are the first known bedload estimates for this region. Snowmelt produced about 90% of annual total sediment yield, and bedload accounted for 20 to 60% of snowmelt yield, stressing the need for selective but comprehensive sampling for management decisions. Empirical predictive equations, based on regression analyses of 13 independent variables, were used to predict 1979 yields. R sup 2 values averaged about 0.88 and standard errors of estimate averaged about 25%. 't' tests of: (1) % bare ground, and (2) length of channels greater than 0.1 meter, showing field evidence of flow during 1978 snowmelt, showed only the latter as significant in predicting sediment yield. This tends to confirm importance of channel network as primary sediment source and subsurface flow as the dominant runoff process. Forest Service channel rating system and channel length from USGS topographic maps were poorly related to sediment yield.
W81-01427

FLUVIAL GEOLOGY AND ARCHAEOLOGY OF THE HOUSATONIC RIVER VALLEY IN NORTHWESTERN CONNECTICUT,
Wesleyan Univ., Middletown, CT. Dept. of Earth and Environmental Sciences.
A. W. Burnett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-163602, Price codes: A04 in paper copy, A01 in microfiche. BA Thesis, June, 1980. 69 p, 17 Fig, 3 Tab, 27 Ref. OWRT-A-078-CONN(1), 14-34-0001-7014.

Descriptors: *Fluvial sediments, *Geologic formations, *Recent epoch, *New England, Geologic history, Geomorphology, Rivers, Landforms, Terraces(Geologic), Bedrock, Geohydrologic units, Channel morphology, Connecticut, *Housatonic River(CT).

The Housatonic River is a glacially modified high gradient New England River that downcut to its present level at least 2500 years ago. The bedrock underlying the river valley affected the glacial development of the valley, the fluvial terrace and floodplain morphology, and the gradient of the present river channel. The low gradient reaches contain level, paried terraces; the high gradient reaches contain sloped, unpaired terraces. The highest fluvial terraces have well developed soil horizons; the lower terraces and present floodplains show no soil horizon development. The relationship of flood discharge (Q) to flood recurrent interval (r.i.), and flood height to r.i. are both direct. The flood elevation varies along the river for a given r.i.
W81-01496

EFFECT OF CHISEL VERSUS MOLDBOARD PLOWING ON SOIL EROSION BY WATER,
Purdue Univ., Lafayette, IN. Agricultural Experiment Station; and Science and Education Administration, Lafayette, IN.
C. B. Johnson, and W. C. Moldenhauer.
Soil Science Society of America Journal, Vol 43, No 1, p 177-179, 1979.

Descriptors: *Erosion, *Runoff, Surface residue, Rainulator studies, Infiltration, *Soil erosion, Rainfall-runoff relationships, Land use, Effects, Sediment transport, Agriculture, Plowing methods, *Soil conservation.

An experiment using simulated rainfall on a field that was chisel plowed annually for 13 years before the experiment to compare erosion from this condition with moldboard plowing in the same field. One treatment was fall moldboard plowed, a second fall chiselled with some residue left on the surface, and a third was untilled in the fall with all residue removed in the spring. All three treatments were disked lightly in the spring. After the initial experiment was completed, residue was added so that all treatments had about 20% surface cover. During the initial rain application with no residue added, soil losses from the third treatment without surface residue were the same as those from the chisel plowed and disked surface with some surface residue. Both these treatments had only 23% of the soil loss of the moldboard plowed and disked treatment. During succeeding simulated rainfall under wet and very wet soil conditions, soil loss from the disked only treatment was up to 80% of that for the moldboard-plowed treatment. When residue was added to all treatments, soil loss from the chisel-plowed treatment was less than one-half that from the moldboard-plowed treatment.
W81-01500

SIZE DISTRIBUTION OF ERODED MATERIAL FROM SIMULATED RAINFALL: EFFECT OVER A RANGE OF TEXTURE,
Purdue Univ., Lafayette, IN.; and Science and Education Administration, Lafayette, IN.
D. Gabriels, and W. C. Moldenhauer.
Soil Science Society of America Journal, Vol 42, No 6, p 954-958, 1978. 1 Fig, 4 Tab, 16 Ref.

Descriptors: *Rainfall, *Erosion, *Soil texture, Splash erosion, Wash erosion, Surface seal, Runoff, Soil detachment, Erosion mechanics, Rainfall simulation, Sediment transport, Particle size, Sediment distribution.

Size distribution of eroded material has implications in deposition mechanics and in carrying capacity for pollutant materials. Dispersed clay, especially the expanding lattice types, has a high carrying capacity for pollutant materials. This study reports size distributions and composition of material detached by water drops and transported in shallow flow. The size distributions of aggregates and primary particles in the splashed, washed, and seal material at different times during a laboratory simulated rainfall were compared for different textured soils. The wash had more finer material than did the splash. The wash and splash material at equilibrium were not different from the original soil, while the seal of all soils had a larger silt content than the original soils. The silt loam soil had seals with about the same clay content as the original soil, while silty clay soils had seals with less clay than the original soils. Of significance from the study is the low percentage of dispersed clay being eroded compared to the percent of clay in the original soil and that this percentage didn't change significantly with time. The most striking differences were between soils and these were influenced mainly by texture and aggregate condition of the original soils.
W81-01501

SOIL AND WATER LOSSES FROM CORN-SOYBEAN ROTATIONS,
Science and Education Administration, Ames, IA.
J. M. Laflen, and W. C. Moldenhauer.
Soil Science Society of America Journal, Vol 43, No 6, p 1213-1215, 1979.

Descriptors: Erosion, Runoff, *Crop rotation, Watershed projection, Sediment concentration, *Water loss, *Soil erosion, Rotations, Effects, Corn, Soybeans, *Experimental forms, Soil conservation.

It has been observed by some that there was greater soil erosion by wind and water following production of soybeans. An experiment was conducted to measure the actual erosion following soybean production compared to that following corn production. Using natural rainfall plots at Beaconfield, Iowa, soil and water losses were measured from soybeans in a corn-soybean rotation and from corn in this same rotation and grown continuously over a 7-year period. Soil losses were found to be greater following soybeans than following corn in either a corn-soybean rotation or in continuous corn. This means more precautions must be taken to control erosion when soybeans are grown on sloping lands than when corn is grown.
W81-01502

TRANSITIONAL PERIODIC BOUNDARY LAYER STUDY,

Iowa Univ., Iowa City. Inst. of Hydrology Research.
B. R. Ramaprian, and A. Mueller.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY12, p 1959-1971, December, 1980. 7 Fig, 17 Ref.

Descriptors: *Flow characteristics, *Reynolds number, *Boundary layers, *Sediment transport, Flow rates, Velocity, Turbidity, Laboratory tests, Mathematical studies.

A periodic oscillatory flow was studied which closely approximated the wave boundary layer. Periodic oscillatory flows are important in the study of sediment transport and other practical hydraulic and coastal engineering topics. Sediment transport is very sensitive to the bed shear stress and therefore to the nature of flow in the wave boundary layer. The experiments indicated that this type of flow can be turbulent at a Reynolds number considerably lower than the critical value for transition for flow over an oscillating flat plate. Detailed velocity measurements were made using laser Doppler nemometry and a digital data acquisition technique which isolated and measured the periodic and random components of the velocity. The behavior of the periodic aspect of the transitional flow was only slightly different from that predicted for a laminar periodic flow at the same oscillation frequency. The turbulent intensities were significant, but were lower than those for fully turbulent boundary layers. (Small-FRC)
W81-01536

SEDIMENT RUN-OFF FROM THE CATCHMENT AREA OF THE CARPATHIAN RIVERS,
Institute of Meteorology and Water Management, Warsaw (Poland).
J. Branski.
Acta Hydrobiologica, Vol 22, No 1, p 89-100, 1980. 1 Fig, 10 Ref.

Descriptors: *Erosion rates, *Rivers, *Sediment yield, Sediment transport, Runoff, Silts, Equations, Watersheds(Basins), Sediments, Water pollution sources, *Poland, Carpathia.

Measurements of sediment load of the Carpathian rivers (Poland) were used to estimate sediment runoff from the catchment area. Measurements of the silt charge (concentration of suspensions in water expressed in g/cu m) and daily water yields were used to calculate the silt charge. Formulae are presented for calculating indices of sediment runoff. Indices of the load of suspension runoff were calculated from the average annual load of suspension discharge in the cross sections of 22 rivers. The indices range from 30 t/sq km to 160 t/sq km. The indices of sediment runoff can be used for rating the erosion processes in the catchment basin. The intensity of erosion is closely connected to the amount of silt in a river. The indices are more reliable than other methods for giving a spatial distribution of this phenomenon. (Small-FRC)
W81-01552

SEDIMENTATION PROCESSES IN THE RESERVOIR LAKE NASSER-NUBIA DURING 1965-1974 AND FUTURE ASPECTS,
B. A. G. Entz.
Water Supply and Management, Vol 4, No 1/2, p 63-66, 1980. 6 Ref.

Descriptors: *Reservoir silting, *Reservoirs, *Mollusks, Mussels, Sediment transport, Lakes, Sedimentation rates, Currents(Water), *Sediment load, *Egypt, Lake Nasser-Nubia(Egypt).

The sedimentation problems in the manmade reservoir Lake Nasser-Nubia were investigated to determine the future of the lakes. The areas of sedimentation, their extension, and their main characteristics were determined, along with the effects of currents. Changes in benthos, particularly molluscs and oligochaetes, since the formation of the lakes were also studied. The bulk of suspended silt was sedimented around the previous second cataract, and the layers were already 10 to 25 m thick in 1974. Heaviest sedimentation took place beside the old river channel in the northern part of the lakes, while north of Wadi Halfa the heaviest sedimentation was in the old river channel itself. There was some correlation between the rate of sedimentation and the stratification of molluscs. In the southern area with a well-defined river bed, there were more than 100 living mussels per sq m. There were no mussels in the central sedimentation area. Only empty shells were found in Lake Nasser, which has poor oxygen levels. (Small-FRC)
W81-01562

HEAVY MINERAL DISTRIBUTION IN BOTTOM SEDIMENTS OF THE BRISTOL CHANNEL, U.K.,
University Coll. of Swansea (Wales). Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W81-01582

CONTRIBUTION TO THE STUDY ON BOTTOM SEDIMENT IN LAKE BALATON. I. DETERMINATION OF PHOSPHORUS MINERALS IN THE SEDIMENT,
Research Inst. for Water Resources Development, Budapest (Hungary). Inst. for Water Quality Control.
E. Dobolyi, and G. Bidlo.
Internationale Revue der Gesamten Hydrobiologie, Vol 65, No 4, p 489-497, 1980. 8 Fig, 3 Tab, 26 Ref.

Descriptors: *Phosphorus, *Lake sediments, *Bottom sediments, *Water pollution sources, Mineralogy, X-ray diffraction, Eutrophication, Electron microscopy, Lakes, Hungary, Lake Balaton.

Chemical, electron microscope, and X-ray diffraction analysis were used to determine the presence of phosphorus containing minerals in the bottom sediment of Lake Balaton. The research was intended to demonstrate whether bottom sediment acted as a sink or source of phosphorus in the eutrophicated lake. A 10 cm thick sediment sample was taken at mid-lake in 4 m of water off Balatonszemes. The phosphorus content of 500-600 microgram/g proved relatively low, and phosphorus bearing minerals were not detected in the original sample under the electron microscope or by X-ray diffraction. The sample was then divided into fractions according to light or heavy mineral density, and was further analyzed using chemical and physical methods. In an enriched sample, the amount of calcium-bound phosphorus was increased to about 50 times the original concentration. In this sample, the presence of hydroxyapatite was found with the electron microscope, and hydroxyapatite and fluoroapatite were found using X-ray diffraction. No other phosphorus minerals were found. (Small-FRC)
W81-01590

EXPERIMENTS ON THE SIGNIFICANCE OF FLOCCULATION IN THE SETTLING OF FINE-GRAINED SEDIMENT IN STILL WATER,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
K. Kranck.
Canadian Journal of Earth Sciences, Vol 17, No 11, p 1517-1526, November, 1980. 6 Fig, 1 Tab, 26 Ref.

Descriptors: *Flocculation, *Settling velocity, *Sedimentation rates, Sediment sorting, Suspended solids, Sedimentology, Stokes Law, Particle size, Turbidity.

The effects of concentration, average grain size and sorting, and mineralogy on the settling rate of fine-grained sediment in still water as flocs and as single grains were studied. Both distilled water and saline solutions were used. In a flocculated suspension the decrease in concentration of a sediment with time was a function of the minus four-thirds power of the time. In salt water, single grain settling dominated over floc settling at lower concentrations. After an initial period, suspensions with different concentrations of suspended sediment attained equal concentrations. Flocs were composed of a mixture of grain sizes in proportion to their distribution in the suspension, all of which had lower settling rates than the floc. The size distribution of sediment remaining suspended after settling was the same as at the start, with the exception of some particles which settled out as single grains. Floc settling behavior was similar among different minerals of similar grain-size characteristics. (Cassar-FRC)
W81-01604

VERTICAL DISTRIBUTION OF METALS IN A SEDIMENT CORE OF A SUBALPINE LAKE INDICATING STAGES IN THE DEVELOPMENT OF CIVILIZATION. (VERTIKALE VERTEILUNG VON METALLEN IM SEDIMENT EINES ALPENVORLANDSEES ALS ZIVILISATIONSINDIKATOREN),
Munich Univ. (Germany, F.R.). Geographisches Inst.
For primary bibliographic entry see Field 5B.
W81-01610

2K. Chemical Processes

THE OXIDATION OF ARSENITE BY AQUATIC SEDIMENTS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W81-01525

2L. Estuaries

QUESTIONS ABOUT DREDGING AND DREDGED MATERIAL DISPOSAL IN LONG ISLAND SOUND.
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
Special Report 28, Reference 79-11 (1979). 136 p, 7 Fig, 7 Tab, 52 Ref, Append. Edited by J. R. Schubel, W. M. Wise and J. Schoof.

Descriptors: *New York, *Connecticut, *Dredging, *Estuaries, *Sedimentation, Turbidity, Tides, Mud, Particle size, Saline water-freshwater interfaces, Aquatic environment, Biomass, Currents(Water), Sediment distribution, Dissolved oxygen, Photosynthesis, *Long Island Sound.

A question and answer format provides a history of dredging and dredged material disposal, an assessment of its effects on the Sound and its biota, an examination of alternative modes of disposal and a discussion of research priorities. Three types of disposal areas are used for dredged material but the majority is dumped at open-water sites within the Sound. Since 1954, 80% of the dredged material has been disposed of at four sites. Three kinds of dredges---suction-cutterhead, hopper, and crane and bucket---are used, depending on the nature and location of the site, and the bidding process. There is concern that if contaminated dredged materials are physically, chemically or biologically reactive on long-term scales, adverse impacts on water quality and biota could occur. Short to intermediate impacts, however, have not been demonstrated. Reductions in benthic abundance, total biomass and species diversity usually occur after deposition of dredged material although repopulation is usually complete within 1 to 1 1/2 years. The type of dredged material, ranging from relatively clean to potentially hazardous, can affect this rate. The Army Corps of Engineers and the Environmental Protection Agency have adopted guidelines for evaluating dredged material and New York and Connecticut have both developed water quality standards pursuant to the 1972 Federal Water Pollution Control Amendments. Permits and certifications must be obtained from these agencies to carry out a dredging project. (Atkins-Omniplan)
W81-01432

QUESTIONS ABOUT DREDGING AND DREDGED MATERIAL DISPOSAL IN THE CHESAPEAKE BAY.

State Univ. of New York at Stony Brook. Marine Sciences Research Center.
Special Report 20, Reference 79-3 (1979). 143 p, 10 Fig, 10 Tab, 53 Ref, Append, 4 Maps. Edited by J. R. Schubel and W. M. Wise.

Descriptors: *Maryland, *Dredging, *Estuaries, *Sedimentation, *Chesapeake Bay, Turbidity, Density currents, Bottom organisms, Sand bars, Dissolved oxygen, Streamflow, Channels, Commercial fishing, Sport fishing, Aquatic habitats, Environmental effects.

The history of dredging and dredged material disposal in the Maryland portion of the Chesapeake Bay, an assessment of its effect on the Bay and its biota, an examination of alternative modes of disposal and a general discussion of research priorities is provided in a question-and-answer format. Agriculture, urbanization and other disturbances of the soil increase the rate of soil erosion and sediment to streams. Since 1870, nearly 82 million cubic yards of material has been removed from Baltimore Harbor Channels, 25% of which has been for maintenance purposes. Three common kinds of dredges are used---suction-cutterhead, hopper, and bucket and scow; the choice is determined by the nature and location of the disposal area and by economics. Environmental concerns regarding dredging include removal of benthic organisms, possible release of oxygen-consuming substances, release of nutrients causing increased phytoplankton production, release of toxic substances, and turbidity. Contaminated deposits may be mobilized and released in a variety of ways; however, the mobilization can be reduced. At disposal sites recolonization begins within a few weeks and is usually completed within 1 to 1-1/2 years. Large-scale dredging has concerned the public, but small to medium projects should be more carefully assessed for their cumulative effect. Monitoring of dredged material and disposal operations is necessary. (Atkins-Omniplan)
W81-01433

A SIMULATION MODEL OF ESTUARINE SUBSYSTEM COUPLING AND CARBON EXCHANGE WITH THE SEA. II. NORTH INLET MODEL STRUCTURE, OUTPUT AND VALIDATION,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
J. K. Summers, W. M. Kitchens, H. N. McKellar, Jr., and R. F. Dame.
Ecological Modelling, Vol 11, No 2, p 101-140, November, 1980. 11 Fig, 5 Tab, 62 Ref.

Descriptors: *Mathematical models, *Carbon, *Energy, *Estuaries, Flow, Model studies, Water temperature, Ambient light, Sea level, Mixing, Freshwater, Sea water, South Carolina.

A first-stage verified model of carbon/energy flux through the North Inlet marsh and estuarine system (Georgetown County, South Carolina) is presented. Forcing functions include sunlight, water temperature, remixing, and sea level. Equations are presented for gross primary production, respiration, egestion, excretion, migration, exchange between the marsh and the water column, organism mortality, tidal remixing, and energy balances. Initial conditions and flows are presented, and validation of the model is discussed. Sixteen of the 21 output variables were validated. The time series output for model compartments and overall system carbon flow were compared with observed data collected over the past ten years. The model is stable and can broadly reproduce some of the major trends of a salt marsh-estuarine system. (Small-FRC)
W81-01577

A NUMERICAL MODEL OF THE JAMES RIVER ESTUARY, VIRGINIA, U.S.A.,
Commonwealth Scientific and Industrial Research Organization, Vronulls (Australia). Div. of Fisheries and Oceanography.
J. S. Godfrey.
Estuarine and Coastal Marine Science, Vol 11, No 3, p 295-310, September, 1980. 6 Fig, 11 Ref.

Descriptors: *Computer models, *Estuaries, *Salinity, Density currents, Flow, Tides, Model studies, Rivers, *James River(VA), Virginia, Tidal effects, *Saline water-freshwater interfaces.

A numerical model is proposed of a partially mixed estuary, using as an example the James River Estuary (Virginia). Temporal changes in density current and vertical salinity stratification at a given point depend only on the longstream gradient of cross-sectional average salinity and the tidal speed averaged over the tidal period. The qualitative features of the solution are similar to those of real and laboratory model partially mixed estuaries. The simplicity of the model is demonstrated by the fact that a 62 day model run on the James River Estuary took only 2 seconds on a CDC-7600 computer. There was good agreement between the data set and the model. A surprising feature of the investigation was that the estuary responded rapidly and strongly to changes in salinity at the mouth. This is more important than changes in river flow or tidal speed in establishing variation in the cross-sectional average salinity in the James River. The physical reason for this is obscure. The model does not work for well-mixed estuaries or when the upstream influx of salt by tidal-induced eddies is considered. (Small-FRC)
W81-01581

VELOCITY SURGES AND ASYMMETRY IN TIDAL CHANNELS,
Hull Univ. (England). Dept. of Geography.
J. S. Pethick.
Estuarine and Coastal Marine Science, Vol 11, No 3, p 331-345, September, 1980. 8 Fig, 4 Tab, 11 Ref.

Descriptors: *Tides, *Water circulation, *Velocity, Mathematical models, *Estuaries, Channel morphology, Flow, United Kingdom.

A simulation model of tidal velocity based on morphological data collected in the Stiffkey marshes, Norfolk, is presented. Velocities predicted by the model are compared with field measurements taken at two stations on the marsh. Velocity surges appear to be a feature controlled by the three-dimensional geometry of the channel or channel system and independent tidal stage inputs. Two inputs necessary for velocity simulation are tidal data, one bankfull and the other 0.4 m overbank, and morphological data obtained by aerial photographs and mapping of the channel system. Shallow water asymmetric tides are responsible for velocity asymmetry, and the branching network of the channel system is primarily responsible for the position and strength of the velocity surges. Maximum surges are associated with the vastly increased discharge rates in channels as overbank tides spill into the marsh surface. Velocity in tidal marshes may be a useful indicator of the maturity of a channel system. (Small-FRC)
W81-01584

THERMALLY-INDUCED AIR AND WATER CIRCULATIONS IN ESTUARINE RIVERS,
Old Dominion Univ., Norfolk, VA. Dept. of Physics.
K. P. Chopra.
Estuarine and Coastal Marine Science, Vol 11, No 3, p 353-357, September, 1980. 1 Fig, 1 Tab, 5 Ref.

Descriptors: *Water circulation, *Mathematical models, *Estuaries, Heat transfer, Convection, Air circulation, Currents(Water), Currents(Air), Flow, Salinity, Winds, Rivers.

A physical theoretical model is presented which explains and predicts thermally induced air and water circulations introduced by contrasts in surface temperatures over an estuarine water and adjoining land mass. Air over an estuarine river is generally cooler than that over land, particularly during the summer days. This is because enhanced evaporative and radiative heat loss are caused by flow and convective transport of heat from subsurface layers. Temperature gradients in estuarine areas are larger than those encountered in sea breezes and cause stronger winds with deeper circulation cells. Increased salinity combined with these winds may induce a backward drift of surface water where downwelling occurs. Since there is no systematically recorded data, comparison of modelling results with field data is not possible. It is proposed that the friction constant for estuarine air probably exceeds 0.0001 per m. (Small-FRC)
W81-01585

CONTROL OF A FJORD BASIN'S DYNAMICS BY TIDAL MIXING IN EMBRACING SILL ZONES,
Evans-Hamilton, Inc., Seattle, WA.
C. C. Ebbesmeyer, and C. A. Barnes.
Estuarine and Coastal Marine Science, Vol 11, No 3, p 311-330, September, 1980. 13 Fig, 34 Ref.

Descriptors: *Tidal effects, *Fjords, *Water circulation, Mixing, Sea water, Washington, Currents(Water), Coasts, Freshwater, Flow, Hydraulic properties, Sills, *Puget Sound(WA).

The dynamics of a large fjord basin lying between comparatively deep sills where tidal mixing is vigorous, Puget Sound's Main Basin, were studied. Tidal action over the 44 m (landward) and 66 m (seaward) sills caused a vigorous two-layer circulation in the basin where no net motion occurred near the average depth of the embracing sills. In the case of a flood tide, upper-layer water was downwelled at the seaward sill and lower-layer water was upwelled at the landward sill. This circulation is quite active at all basin depths throughout the year. Currents were computed from differences in dissolved oxygen between hydrographic stations, and compared well with measured currents. Bulk residence time in the lower layer was found to be about three weeks, a short time for so large a fjord. The water blend in the basin averages about 90% oceanic water and 10% fresh water. The basin showed marked sensitivity to tidal action in the sill zones. Transport in the upper layer was directly proportional to the tidal prism inland of the landward sill zone, and there was an exponential response to abrupt changes in freshwater flowing into the seaward sill zone. (Small-FRC)
W81-01586

CONCENTRATION AND MICROBIOLOGICAL UTILIZATION OF SMALL ORGANIC MOLECULES IN THE SCHELDT ESTUARY, THE BELGIAN COASTAL ZONE OF THE NORTH SEA AND THE ENGLISH CHANNEL,
Brussels Univ. (Belgium). Lab. of Oceanography.
For primary bibliographic entry see Field 5B.
W81-01588

DISPERSAL OF MICROFUNGI IN THE THAMES RIVER ESTUARY OF EASTERN LONG ISLAND SOUND,
Connecticut Univ., Groton. Marine Science Inst.
J. C. Cooke.
Estuarine and Coastal Marine Science, Vol 11, No 5, p 537-545, November, 1980. 9 Fig, 1 Tab, 13 Ref.

Descriptors: *Fungi, *Estuaries, *Mixing, Sediment transport, Bioindicators, Microorganisms, Long Island Sound, *Thames River(CT), Connecticut, Soil fungi, Saline water-freshwater interfaces, River flow, Seasonal.

Terrestrial microfungi were used as bioindicators to study the movement of water and sediment in the Thames River Estuary, Long Island Sound. Samples collected at 6 stations in the river and in the sound east of the river mouth from February 1974, to August, 1976, revealed seasonal distribution patterns, reaching a maximum count in Nov.-May and a minimum in June-Sept. River bottom samples contained fewer colony-producing organisms than surface river water. The pH and concentration of total suspended matter had no significant effect on distribution of fungi. Temperature, precipitation, river discharge, and salinity showed correlation with fungi counts and are the major factors affecting dispersion of fungi. Movement and dispersion of microfungi were observed during mixing of river water and saline water. (Cassar-FRC)

W81-01589

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PROCESS FOR INCREASING THE EXCHANGE YIELD IN ION EXCHANGE PROCESSES,
Sandor Vajna (Germany, F.R.). (Assignee).
For primary bibliographic entry see Field 5D.
W81-01459

APPARATUS FOR DESALINATING WATER,
R. E. Diggs.
U.S. Patent No 4,199,407, 18 p, 21 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 993, No 4, p 1359-1360, April 22, 1980.

Descriptors: *Patents, *Desalination, *Desalination apparatus, *Solar radiation, Heat exchange, Separation techniques, Evaporation, Condensation, Equipment.

The saturation temperature of the contaminated water being vaporized by the distillation apparatus is very low as compared to the saturation temperature at atmospheric pressure. Furthermore, condensation of the water vapor occurs at, or near, atmospheric pressure and therefore the water vapor is at, or below, the saturation temperature of water at atmospheric pressure. Solar energy can be utilized to supply sufficient heat input to raise the temperature of large quantities of contaminated water to above the saturation temperature required in the vaporization process occurring in the evaporation chamber. The water vapor is then transferred to a condensation chamber where the pressure is at, or near, atmospheric pressure, hence less heat has to be removed from the water vapor to condense it, and the condensation step occurs quite rapidly. Once vaporized, the waver vapor and the dissolved solids are separated, and the vapor is condensed in a separate chamber, thereby substantially reducing the possibility of recontamination of the distillate with solids which have been removed from the cater by the distillation process. (Sinha-OEIS)
W81-01463

APPARATUS FOR DESALINATING WATER,
R. E. Diggs.
U.S. Patent No 4,199,406, 18 p, 21 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 993, No 4, p 1359, April 22, 1980.

Descriptors: *Patents, *Desalination, *Desalination apparatus, *Solar radiation, Heat exchange, Separation techniques, Evaporation, Condensation, Equipment.

Contaminated water flows across a grid and into a storage tank. The grid utilizes solar energy to heat that water to a predetermined temperature. A heat transfer structure which is dome-shaped and receives water from the storage tank and a preheater utilizing solar energy heats the water to a further predetermined temperature. An evaporator receives the heated water and exposes it to a vacuum condition so that the temperature of the water is above the saturation temperature. The water is thus vaporized and dissolved solid contaminants are separated. The solids are deposited on moving belts and moved into a solids removal system. The solids removal system comprises trap door pairs upon which the solids are deposited and which are sequentially opened so that the vacuum conditions existing in the evaporator are not disturbed. The water vapor is removed and transfered to the heat transfer structure where it is condensed for form distillate. The distillate is transfered to a collection area. (Sinha-OEIS)
W81-01464

DEVELOPMENT OF COMPOSITE HOLLOW FIBERS--PHASE II,
Bend Research, Inc., OR.
W. C. Babcock, R. W. Baker, R. P. Barss, G. C. Corson, and B. A. Kruse-Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-161010, Price codes: A03 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, Sept. 15, 1980. 31 p, 13 Fig, 6 Tab, 11 Ref. OWRT-C-90261-D(No 9521)(1), 14-34-0001-9521.

Descriptors: *Membranes, *Desalination apparatus, Desalination processes, Reverse osmosis, Osmotic pressure, *Composite membranes, *Hollow fiber membranes, *Inside-skinned membranes, *Membrane modules, Hollow fiber modules.

The report describes the results of a program to develop inside-skinned, composite hollow fibers for brackish-water desalination by reverse osmosis. In a previous program, polysulfone hollow fibers were developed that have sufficient strength to withstand 400 psi internal pressure. During this program, minor improvements were made in the polysulfone fibers and a procedure was developed for reliably coating the lumen surfaces of the fibers with an NS-100 membrane. Modules containing several hundred fibers and having a combined membrane area of 1 sq ft exhibited rejections in excess of 90% and fluxes of 5 to 20 gfd at 400 psi with 0.5 wt% NaCl. The best module performance was 98.1% NaCl rejection and a flux of 13.4 gfd.
W81-01465

3B. Water Yield Improvement

PROJECT SKYWATER, DATA MANAGEMENT USERS GUIDE,
Water and Power Resources Service, Denver, CO. Office of Atmospheric Resources Management.
Report, July, 1980. 22 p, 4 Fig.

Descriptors: *Cloud seeding, *Water supply development, *Data collections, *Weather data, Weather modification, Data storage and retrieval, Meteorological data, Management, Precipitation(Atmospheric), Remote sensing.

Project Skywater is a comprehensive research program designed to develop additional water supplies by cloud seeding techniques. About 70% of the program is conducted through contracts with universities, private firms, and local, state, and Federal agencies. The various Skywater projects produce large quantities of data. Data sources include radar, satellite, rawinsondes, precipitation gages, cloud physics aircraft, and automated weather stations. Since 1975, thousands of computer tapes have been used to record data. To assure that high quality data are archived on the Skywater data base in a timely manner, data management influences must be applied throughout all phases of activities: development of request for proposal, contract, work plan, data collection, data processing, and archival. The objectives of data management are: to develop and maintain a Skywater data base management system with quality controlled, space-efficient archival techniques, and fast, simple retrieval procedures which are cost-effective and reliable, to maintain a current inventory of data collected and their archival status; and to provide data to analysts as requested. (Moore-SRC)
W81-01478

ANALYSIS OF DIGITIZED M-33 RADAR DATA FROM TEXAS HIPLEX, 1976-1978,
North American Weather Consultants, Salt Lake City, UT.
J. L. Sutherland, H. R. Swart, and D. A. Griffith.
Final Report, Volume 1 prepared for Texas Department of Water Resources, November, 1980. 85 p, 11 Fig, 22 Tab, 13 Ref. 14-0013.

Descriptors: *Texas, *Cloud seeding, *Radar, *Precipitation(Atmospheric), Weather modification, Clouds, Fronts(Atmospheric), Meteorological data, Data collections, Rainfall.

The Texas High Plains Experiment (HIPLEX) is a weather-oriented research effort intended to reduce the scientific uncertainties of beneficial and acceptable management of precipitation from summer cumulus clouds. Digitized M-33 radar data were analyzed to examine cloud seeding effects, produce an echo summary, generated hourly radar-derived rainfall maps, and determine environmental controls on echo occurrence. Possible seeding effects were detected in terms of increases in echo volume and area. Problems with radar data quality and a lack of randomization compromise the seeding analysis. A total of 11,207 echoes were detected. About 90% were convective cells, with warm-topped cells outnumbering coldtopped cells by two to one. About ten% of the echos were clusters (three or more reflectivity peaks). Fourteen line echoes were observed. In spite of their relative infrequence, lines were the dominant echo in terms of echo area, height, reflectivity and duration. Clusters were ranked next. Line echoes generally occurred with 500 mb troughs and along surface fronts. Clusters occurred under all weather patterns, although they were somewhat more frequent near (but not along) fronts. Days with cells only (no clusters or lines) were all non-frontal. Soundings near cells were relatively drier at all levels and also more unstable than soundings near clusters or lines. The mean top of the positive area deduced from soundings near lines was 75 mb greater (about 1 km lower) than the corresponding mean for cells. (Moore-SRC)
W81-01480

WATER SUPPLY PROBLEMS OF THE CITY OF MOSUL, AN EXTENSION OF THE ANCIENT CITY OF NINEVAH,
Mosul Univ. (Iraq). Coll. of Engineering.
For primary bibliographic entry see Field 3D.
W81-01570

3C. Use Of Water Of Impaired Quality

SEWAGE FARMING IN IRAQ: A POTENTIAL HAZARD FOR POLLUTION,
Environmental Pollution Research Center, Baghdad (Iraq).
S. M. Mutlak, Y. A. Hamdi, M. A. Nour, N. Bakal, and M. Al-Gazzaly.
Journal of Environmental Quality, Vol 9, No 4, p 677-680, October/December, 1980. 3 Fig, 2 Tab, 10 Ref.

Descriptors: *Sewage bacteria, *Irrigation practices, Coliforms, Aerobic bacteria, Irrigation, Sewage effluents, Liquid wastes, *Path of pollutants.

Microbial pollution problems associated with the use of raw sewage for agricultural purposes in Iraq are investigated. Composite samples of 10 individual surface and subsurface soil samples were taken from a sewage-irrigated farm near Baghdad. The soil was classed as fine silty. Some samples were incubated at 10 and 37C for 5 wk. Lettuce plants were obtained from the farm during a 9 wk period. Average total aerobic bacterial counts in different samples were 4000000 cells/g for surface and subsurface soils, and 450000000 cells/ml for sewage. Average counts of coliform were 400000 cells/g for surface and subsurface soils, and 3400000 cells/ml for sewage. The population of fecal streptococci was 6000 cells/g for surface soil, 4000 cells/g for subsurface soil and 17000 cells/ml for sewage. In general the sewage contained higher populations of total bacteria, coliforms and fecal streptococci than did the soils. Coliforms were present in the lettuce plants with an average of 4, 24, and 43 cells/g of tissue for the inner leaves, outer leaves, and head, respectively. These results indicate that the use of untreated sewage for agricultural purposes is hazardous and safety measures must be taken. (Baker-FRC)
W81-01528

URBAN AND AGRICULTURAL DEVELOPMENT: THE WASTE WATER ROLE,
For primary bibliographic entry see Field 5D.

W81-01640

3D. Conservation In Domestic and Municipal Use

WATER SUPPLY PROBLEMS OF THE CITY OF MOSUL, AN EXTENSION OF THE ANCIENT CITY OF NINEVAH,
Mosul Univ. (Iraq). Coll. of Engineering.
F. Y. R. Agha, T. A. Mahmoud, and S. Ahmad.
Water Supply and Management, Vol 4, No 3, p 129-137, 1980. 6 Fig, 3 Tab, 15 Ref.

Descriptors: *Water yield improvement, *Water supply development, *Water shortage, Water management(Applied), Water supply, Water allocation(Policy), Water rates, Water utilization, *Iraq, *Mosul(Iraq).

The city of Mosul (Iraq) has grown rapidly, and the existing water supply falls short of the demand particularly in the summer months. A study was conducted to identify the major factors which affect the present water supply, to estimate the future water requirements of the city, and to suggest ways and means to meet the city's water needs. Presently, water is withdrawn from the river, treated, and piped to the city. Population growth was estimated, and the overall water demand was estimated to increase at about 3% per year. The installation of a raw water supply system for watering lawns and public gardens, and attempts to eliminate waste and leaks, will reduce the demand for treated water. Proper metering and realistic pricing of treated water will help end waste. A third water treatment plant which will supply 198,000 cu m of treated water per day will be completed in 1980. But even with this new plant, Mosul demand will exceed the water supply by 1992. (Small-FRC)
W81-01570

3F. Conservation In Agriculture

IRRIGATION HOSE,
Sumitomo Chemical Co. Ltd., Osaka (Japan). (Assignee).
S. Kojimoto, T. Sato, J. Ono, T. Mori, and S. Suzuki.
U.S. Patent No 4,199,106, 8 p, 10 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 4, p 1259, April 22, 1980.

Descriptors: *Patents, *Irrigation, *Application equipment, Hoses, Irrigation practices, Irrigation efficiency, *Drip irrigation.

An irrigation hose is produced by melt-sticking double thermoplastic resin film in a plane along longitudinal parallel lines so as to form two to three passages, one a supply passage and other being constant pressure passages. The supply passage is connected to each constant pressure passage by communicating holes which are formed by non-melt-stuck portions spaced in the melt-stuck line between both passages. The constant pressure passage has water-irrigating holes which are formed by non-melt-stuck portions spaced in an outside melt-stuck line. The improvement comprises making small melt-stuck portions in the vicinity of the communicating holes and/or water-irrigating holes. This assures uniform water-irrigation on both level and sloping fields. (Sinha-OEIS)
W81-01450

LOW VOLUME SPRAY DEVICE FOR SURFACE IRRIGATION SYSTEM,
Olson Irrigation Systems, Santee, CA. (Assignee).
D. Olson, and R. P. Georges.
U. S. Patent No 4,199,105, 4 p, 4 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 993, No 4, p 1259, April 22, 1980.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Application equipment, Irrigation practices, Irrigation efficiency, Nozzles.

A low volume spray device for irrigation systems has a lower tubular end portion that is beveled to facilitate its insertion into a plastic conduit. Its upper end forms a nozzle portion with a small orifice and a deflector that controls the spray pattern. The device is preferably molded from plastic material so as to be inexpensive yet long lasting. (Sinha-OEIS)
W81-01451

CONTROLLED THRUST, ROTARY, ADJUSTABLE TOPOGRAPHY SPRINKLER,
R. A. Rodriguez.
U.S. Patent No 4,198,001, 9 p, 11 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 889, April 15, 1980.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Application equipment, Irrigation practices, Irrigation efficiency, Nozzles.

This invention pertains to irrigation devices capable of varying their irrigation patterns. It achieves the desired effects through the use of only five major moving parts arranged about a central hollow cylindrical frame. Two parts comprise the main irrigation mechanism; a hollow rotary unit that holds a rotary nozzle, and the nozzle which is mounted on the rotary unit at a slight radial distance from its axis of ration and in a manner such that the irrigation jet thrust produces a rotating torque on the hollow rotary unit. Two other parts comprise the main mechanisms for harnessing and controlling the resultant force of irrigation jet and its induced torque, a torque buffing impeller and its connecting means to the rotary unit. An additional moving part, a nozzle rotation restrainer mounted on the hollow rotary units acts on the nozzle to restrain its rotation during particular motions. A fixed one piece adjustable contour plate consists essentially of the contour surface, which via a contact leg extending from the nozzle and riding on its surface its countour variations are transmitted into nozzle rotation. (Sinha-OEIS)
W81-01461

SOIL MOISTURE SAMPLER AND CONTROLLER,
J. D. Neal.
U.S. Patent No 4,197,866, 8 p, 2 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 844, April 15, 1980.

Descriptors: *Patents, *Irrigation systems, *Soil moisture, Measurement, Automatic control, Electronic equipment, Temperature, Irrigation efficiency.

Periodically, the soil moisture sampler and controller automatically activates in-ground probe(s) to measure the soil moisture. The resulting output signal indicative of the soil moisture is adjusted for soil ambient temperature and compared to a pre-set soil moisture is less than a pre-set value, an irrigation timer is activated which causes the soil to be irrigated for a preselected time interval. (Sinha-OEIS)
W81-01462

IRRIGATION EFFICIENCY AND CONTROLLED ROOT-ZONE WETTING IN DEEP SANDS,
Florida Univ., Gainesville. Water Resources Research Center.
L. C. Hammond, R. S. Mansell, W. K. Robertson, J. T. Johnson, and H. M. Selim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-161036, Price codes: A05 in paper copy, A01 in microfiche. Publication No 52, 1981. 80 p, 31 Fig, 26 Tab, 16 Ref, 1 Append. OWRT A-034-FLA(2), 14-34-0001-9010.

Descriptors: *Irrigation efficiency, *Deep sands, *Controlled root-zone wetting, Evapotranspiration, Drainage, Subsurface asphalt barrier, Sands, *Crop response, Irrigation practices, Corn, Soybeans, Peanuts, *Florida, Gainesville(FL), Live Oak(FL).

Ten field water management experiments were conducted with corn, soybeans and peanuts during 1977, 1978, and 1979 on well-drained sandy soils at Gainesville and Live Oak. Irrigation scheduling treatments varied from one to eight per experiment. A simple computer simulation model provided an estimate of seasonal evapotranspiration (ET), drainage, and change in soil storage. These data and calculated water use efficiencies served as a test of the effectiveness of various irrigation scheduling strategies, and provided information on crop response to water stress. Yields increased linearly with estimated ET. Regression of corn yields on estimated ET gave the following 3-year average results for Gainesville and Live Oak, respectively: $Y = 661X - 22,895$ ($R \text{ sup } 2 = 0.90$), $Y = 471X - 12,964$ ($R \text{ sup } 2 = 0.73$), where Y is grain yield, kg/ha-cm, and X is ET, cm. These findings were interpreted to mean that the most efficient crop production use of water is obtained when water is supplied to meet the full seasonal ET needs imposed by the atmosphere. In addition, a strategy of light, frequent irrigation of only the top 30 cm of sandy soils will produce high yields with minimum deep seepage loss of water and nutrients.
W81-01467

EFFECTS OF IRRIGATION REGIMES ON YIELD AND WATER USE OF SNAP BEAN (PHASEOLUS VULGARIS L.),
Georgia Coastal Plain Experiment Station, Tifton.
J. R. Stansell, and D. A. Smittle.
Journal of the American Society of Horticultural Science, Vol 105, No 6, p 869-873, November, 1980. 5 Fig, 6 Tab, 12 Ref.

Descriptors: *Irrigation efficiency, *Beans, *Evapotranspiration, Consumptive use, Irrigation effects, Soil moisture, Soil-water-plant relationships, Plant growth, Water requirements.

Two snap bean cultivars, Galagreen and Eagle, were grown as spring and fall crops in water-protected irrigation plots. Differences in water use were not significant in spring and fall crops (169 and 180 mm) or in cultivars (173 and 176 mm), but Eagle produced more than double the yield of Galagreen. Pod yield was greatest when beans were continually irrigated at a soil water tension of 25 kPa. Irrigation when soil water tensions reached 50 and 75 kPa reduced pod yields by 41 and 47% respectively. Snap beans were adversely affected by a water stress of 75 kPa at any one stage of growth: pre-bloom, bloom, and post-bloom. The most efficient water use was the 25 kPa treatment, which produced 0.62 MT per mm. Application of water at soil water tensions of 50 and 75 reduced water use efficiency by 27 and 35%. Daily evapotranspiration rates in mm were: 25 kPa treatment, $1.52 + 0.05x$ (where x is the age of the plant in days); 50 kPa treatment, $0.515 + 0.054x$; and 75 kPa treatment, $0.567 + 0.046x$. The mean daily rate of evaporation was 4.88 cm per day. Relationships of evapotranspiration to evaporation from an open pan were determined and can be used to accurately schedule irrigation. (Cassar-FRC)
W81-01523

FURROW EROSION AND SEDIMENT LOSSES ON IRRIGATED CROPLAND,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
R. D. Berg, and D. L. Carter.
Journal of Soil and Water Conservation, Vol 35, No 6, p 267-270, November/December, 1980. 6 Fig, 2 Tab, 8 Ref.

Descriptors: *Erosion, *Channel erosion, *Furrow irrigation, *Irrigation ditches, *Sediment transport, Idaho, Slopes, Phosphorus, Sugar beets, Cereal crops, Alfalfa, Cultivated lands, Erosion control, Cover crops, Soil stabilization, Strip cropping, Irrigation practices, Water conveyance.

Between 0.2 and 63.0 tons per acre of sediment were lost during one irrigation season from furrow irrigation on 49 Idaho farms studied. Erosion was worst in fields planted with row crops and with slopes exceeding 1%. Cereal crops lost one-tenth the sediment compared with row crops, and alfalfa accumulated sediment. Phosphate losses generally followed sediment losses with a few fields losing

excessive amounts of phosphates. Surface runoff exceeded 30% in most fields, indicating that furrow stream inflow was excessive. Early season irrigation caused more erosion than later because plants and root systems stabilized the furrows. Erosion and phosphorus losses may be minimized by avoiding row crop irrigation on steeper slopes, controlling furrow stream size, keeping the tailwater ditch shallow, maintaining a vegetative filter strip (grasses, alfalfa, cereals), constructing sediment retention basins, irrigating every other furrow where possible, seeding crops directly in furrows, and using herbicides to reduce cultivation requirements. (Cassar-FRC)
W81-01538

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

FLOOD CONTROL OPERATIONS AND OPTIMIZATION: A CASE STUDY FOR BONNY RESERVOIR, COLORADO,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W81-01494

STORMWATER DETENTION BASINS MUST CONTROL MORE THAN RUNOFF,
Mosquito Extermination Commission, Morris County, NJ.
F. G. Schimmenti.
American City and County, Vol 95, No 12, p 41-42, December, 1980.

Descriptors: *Storage, *Storm runoff, *Urbanization, Design flow, Water pollution, Pondage, Settling basins, Storm water, Urban runoff, Design, Design criteria, Project planning, Engineering structures, Spillways, Overflow, Pipes, Weirs.

Various facilities have been designed to detain stormwater runoff to prevent property damage from flooding and erosion related to increased development. These facilities are in response to building regualtions which specify that runoff levels can not exceed those prior to construction. Such facilities include detention basins, ponds, and recharge basins, which can produce nuisance problems such as breeding mosquitoes and stagnant water. Designs for ponds or basins should incorporate components which provide for flow-through of fresh water, surface feeding fish, and a minimum water depth and slope. Outlet structures should be kept free of debris, be accessible for maintenance, and include an emergency spillway. (Titus-FRC)
W81-01527

4B. Groundwater Management

QUALITATIVE ASSESSMENT OF THE ECONOMIC IMPACTS OF A RISING WATER TABLE, LAS VEGAS, NEVADA,
Nevada Univ. System, Reno. Water Resources Center.
For primary bibliographic entry see Field 6B.
W81-01469

4C. Effects On Water Of Man's Non-Water Activities

DEFORESTATION AND INCREASED FLOODING OF THE UPPER AMAZON,
Missouri Botanical Garden, St. Louis.
A. H. Gentry, and J. Lopez-Parodi.
Science, Vol 210, No 4476, p 1354-1356, December, 1980. 1 Fig, 2 Tab, 20 Ref.

Descriptors: *Amazon River, *Surface runoff, *Floods, *Runoff, Forest watersheds, Water level fluctuations, Tropical regions, Annual flood, Watersheds(Basins), Drainage, Rain forests, Water levels, Peru, Iquitos(Peru), River basins, *Lumbering, Effects, Land use, Rivers, High water mark, Water balance, Low water mark.

Flood crests of the upper Amazon River measured at Iquitos, Peru, averaged 27.1 meters during 1970-1978, a significant increase compared to the 25.0 meters measured during the previous decade. Low water levels (approximately 19.5 meters average) and rainfall did not vary appreciably during this period. In fact, during 1978, a drought year, the high water level exceeded that of any year prior to 1970. The greater amount of runoff is believed to be a result of increased deforestation in the upper parts of the Amazon watershed in Peru and Ecuador. This demonstrates the noticable, perhaps irreversible, changes in water balance resulting from relatively limited forest destruction. (Cassar-FRC)
W81-01629

ON-SITE DISCHARGE SOLVES STORMWATER PROBLEMS,
Russell and Axon, St. Louis, MO.
A. Karaca.
Public Works, Vol 111, No 3, p 54-55, March, 1980. 2 Fig.

Descriptors: *Urbanization, *Storm runoff, *Storm drains, Floods, Subsurface discharge, *Flood control, Urban drainage, Ditches, Percolation, Watersheds, Penetration, Permeability, Groundwater, Water table, Piezometry, Illinois, Storage capacity, Economic feasibility, *Centerville(IL).

Some of the conditions causing flooding in the Matheson Manor Housing Complex, Centerville, Illinois, and the measures taken to correct the problem are discussed. Paving of farmland for the complex decreased natural drainage surfaces and soil absorptive surface area of the watershed. Flooding occurred under normal rainstorms, and drainage ditches experienced ponding followed by stagnation. Costs for the installation of sewer lines, pumps and outfall structures were considered to be too high, so the St. Clair County Housing Authority agreed on the construction of an underground discharge ditch to allow percolation of the runoff water through granular rock medium to the natural groundwater table. A pervious soil layer and sufficiently deep groundwater levels were important for successful operation of the ditch. Investigations were made to determine the feasibility of the proposed system by examining water table levels over the past 100 years. Subsurface tests were conducted to determine the penetration capacity of the soil. It was concluded that a 10-foot wide, 4-foot, 6-inch deep and 275-foot long trench with an 18-inch wide and 5-foot, 6-inch deep second trench at the midpoint of the trench bottom would satisfy the design criteria. Piezometric and visual measurements are scheduled to gather empirical data on this new method of stormwater discharge. (Geiger-FRC)
W81-01636

4D. Watershed Protection

EMPIRICAL STUDIES OF SOIL CONSERVATION TECHNIQUES AND DESIGN PROCEDURES,
Purdue Univ., Lafayette, IN.; and Science and Education Administration, Lafayette, IN.
W. C. Moldenhauer, and G. R. Foster.
In: Proceedings, International Conference on Soil Conservation, National College of Agricultural Engineering, Silsoe, Bedford, England, July 21-25, 1980, p 13-29, (1981). 54 Ref. Wiley Interscience.

Descriptors: *Soil erosion, Research techniques, *Rainfall, *Runoff, *Soil conservation, Erosion control, Research facilities, Reviews, Technology.

The main body of knowledge on soil conservation techniques and design procedures is from empirical studies. Soil conservation research is generally aimed at a better understanding of soil erosion and its control. Since complexity reduces almost all erosion research to some level of empiricism, clear identification of empirical studies is not possible. For this discussion, empirical studies are ones where data can be collected from plots and small watersheds to directly measure the influence of a major factor or factors on erosion as it might occur in typical field situations. Analytical and modelling analyses define the current level of knowledge, or more precisely what is not known. They provide clues to the sensitive parameters, provide guides for design of experiments, and give hints to interactions that are useful during data interpretation. Models suggest equation forms for more applied and field design procedures. Similarly, basic research provides identification and fundamental understanding of important erosion processes. Modelling and basic research should not be ignored as being inapplicable in an applied research programme. Natural runoff plots, small watersheds, rainfall simulators, laboratory tests, field tests, models, statistics, calculus, computers, tabulation sheets, theoretical studies, empirical studies, basic studies, applied studies, etc., are research tools. A well equipped mechanic has all of these in his tool chest and selects the ones that are most appropriate for the given task.
W81-01499

EFFECT OF CHISEL VERSUS MOLDBOARD PLOWING ON SOIL EROSION BY WATER,
Purdue Univ., Lafayette, IN. Agricultural Experiment Station; and Science and Education Administration, Lafayette, IN.
For primary bibliographic entry see Field 2J.
W81-01500

SOIL AND WATER LOSSES FROM CORN-SOYBEAN ROTATIONS,
Science and Education Administration, Ames, IA.
For primary bibliographic entry see Field 2J.
W81-01502

INFLUENCE OF SURFACE ROUGHNESS AND CLOD SIZE AND STABILITY ON SOIL AND WATER LOSSES,
Purdue Univ., Lafayette, IN.; and Science and Education Administration, Lafayette, IN.
C. B. Johnson, J. V. Mannering, and W. C. Moldenhauer.
Soil Science Society of America Journal, Vol 43, No 4, p 772-777, 1979. 6 Fig, 7 Tab, 11 Ref.

Descriptors: *Water loss, *Infiltration, *Surface roughness, Clod size, Compaction, *Soil erosion, Soil tilling, Soil types, Particle size, *Erosion control, *Compacted soils.

Rough cloddy surfaces increased infiltration and decreased soil erosion compared to smoother surfaces as determined by simulated rainfall studies. Overtilling reduced surface roughness and clodddiness. One field experiment showed that a rough surface decreased runoff by 77% and soil erosion by 89% of that from a smooth surface. Tillage of wet soil increased surface roughness, but another field experiment showed that clods resulting from plowing the soil when wet were quite unstable compared with clods from plowing nearer the upper plastic limit. Tilling of compacted soil results in greater clodddiness than tilling of uncompacted soils. However, a laboratory experiment showed that compacted loam clods were less resistant to breakdown by water drop energy than those from uncompacted soil. Compaction of silty clay loam and silty clay soils did not change their stability significantly. To be effective as an erosion control measure, soil clods must be large enough and stable enough to keep infiltration at a high level until the crop canopy covers the soil surface. These studies describe the size and stability necessary to maintain a high level of runoff and erosion control.
W81-01503

FURROW EROSION AND SEDIMENT LOSSES ON IRRIGATED CROPLAND,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.

For primary bibliographic entry see Field 3F.
W81-01538

A MODELING APPROACH TO WATERSHED CONSERVATION PLANNING,
Economics, Statistics, and Cooperatives Service, Broomall, PA.
C. W. Ogg, R. E. Heimlich, and J. E. Hostetler.
Journal of Soil and Water Conservation, Vol 35, No 6, p 271-273, November/December, 1980. 3 Tab, 6 Ref.

Descriptors: *Watershed management, *Erosion control, *Agricultural watersheds, Linear programming, Soil management, Mathematical models, *Model studies, Cultivated lands, Land management, Conservation, Agronomy, Agriculture, Adoption of practices, Farm management, Small watersheds, Contour farming, Cover crops, Terracing, Little Nottoway(VA), Virginia.

A linear programming model, developed for a cooperative river basin study, was applied to the Little Nottoway watershed, Virginia. This approach provides individual farm plans and a list of crops and farming practices producing maximum net revenue and consistent with watershed conservation. For example, knowing soil type, acreage, and erosion limits, the model can tell a farmer how many acres of which crops to plant using optimum methods such as contour, terrace, winter cover crop, or combinations of these, for maximum profit. This model can also help planners assess alternative erosion control plans and identify critical areas needing assistance. (Cassar-FRC)
W81-01539

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

EVALUATION AND APPLICATION OF DIALYSIS TITRATION TECHNIQUE FOR DETERMINATION OF COMPLEXING CAPACITY OF FRESHWATERS,
New Hampshire Univ., Durham. Dept. of Chemistry.
J. H. Weber, and R. E. Truitt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-161077, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of New Hampshire Completion Report, Research Report 32, January 1981. 38 p, 4 Tab, 74 Ref. OWRT-B-004-NH(6), 14-34-0001-8132.

Descriptors: *Dialysis, *Volumetric analysis, Freshwater, Analytical techniques, *Trace elements, *Copper, *Cadmium, Cations, Membrane processes, Separation techniques, Diffusion, Membrane, Evaluation, Testing, Ions, Water quality, Estimating, Instrumentation, Laboratory tests, Research and development.

The report is divided into two sections. The first section covers an evaluation of dialysis titration as a method for determining the complexing capacity (metal ion binding ability) of 10 mg/liter soil-derived fulvic acid (SFA) solutions. The complexing capacities of SFA for Cu(II) or Cd(II) were measured at pH 5, 6 and 7 during dialysis experiments, and were found to be greater for Cu(II) than Cd(II) at the same pH, and increased for both cations as pH increased. A comparison of dialysis and Cu(II) selective electrode results showed no inter-technique difference in their ability to measure complexing capacity. In the second section, seven New Hampshire freshwater samples having naturally-occurring ligands were tested for Cu(II) and Cd(II) binding by dialysis titration. The results were termed potential binding levels (PBL), and were 1.1-15.1 micromolar for Cu(II) and 0.0-9.7 micromolar for Cd(II). Correlations of alkalinity, pH, dissolved organic carbon, hardness, conductance, and UV absorbance to Cu(II) and Cd(II) PBL values show significant correlation (p,0.90) of Cu(II) with inorganic but not organic sample properties, while Cd(II) PBL values had no significant trends. (Zielinski-IPA)
W81-01471

PICLORAM IN WATER AND SOIL FROM A SEMIARID PINYON-JUNIPER WATERSHED,
Science and Education Administration, Tucson, AZ.
T. N. Johnsen, Jr.
Journal of Environmental Quality, Vol 9, No 4, p 601-605, October/December, 1980. 4 Fig, 1 Tab, 19 Ref.

Descriptors: *Picloram, *Herbicides, *Pollutant identification, Water quality, Soil contamination, Semiarid climates, 2,4-D, Watersheds, *Path of pollutants.

Residues of picloram were measured in runoff water and soil from a semiarid pinyon-juniper rangeland area located in north-central Arizona. The area had been treated with applications of 2.8 kg acid equivalent (ae) of picloram and 5.6 kg ae 2,4-D as the triisopropanolamine salts in 94 liters of water/ha laid by helicopter over 13 ha. Runoff samples were collected from 10 different areas and assayed for picloram with an electron capture gas chromatograph method sensitive to 0.4 ppbw (parts per billion, by weight) picloram in water. Soil samples were collected from 3 locations at 1, 10, 22, 32, 44, 57, and 69 mo after application. Composite soil samples were taken from depths of 0-8, 8-15, 15-30, 30-45, 45-60, 60-90, and 90-122 cm at each location. Soils were assayed by use of soybean assays for biological activity. The first runoff water samples contained the highest picloram concentration, 320 ppbw. The last detection of picloram in a water sample was at a concentration of 1 ppbw 35.5 mo after application. Picloram was last detected in soils collected 44 mo after treatment. One month after application, 92% of the herbicide recovered was in the surface 8 cm of the soil. Nine months later 66% of the picloram found was in the 90-122 cm depth. Further study suggested that in time small amounts of picloram might move to the soil surface by capillary action and be exposed to direct sunlight and thus destroyed during each wetting-drying cycle of the soil. (Baker-FRC)
W81-01521

EXTRACTION, SPECIATION, AND ANALYSIS OF ARSENIC AND ARSENICAL HERBICIDES IN RUNOFF: EVALUATION OF SIMPLE METHODS AT THE PPB LEVEL,
Southern Weed Science Lab., Stoneville, MS. Chemistry Dept.
For primary bibliographic entry see Field 5B.
W81-01530

SELECTED ORGANIC PESTICIDES, OCCURRENCE, TRANSFORMATION, AND REMOVAL FROM DOMESTIC WASTEWATER,
North Texas State Univ., Denton.
For primary bibliographic entry see Field 5D.
W81-01543

DETERMINATION OF PHOSPHORUS IN WASTE-WATERS BY INDUCTIVELY-COUPLED PLASMA ATOMIC EMISSION SPECTROMETRY,
Government Industrial Research Inst., Nagoya (Japan).
T. Ishizuka, K. Nakajima, and H. Sunahara.
Analytica Chimica Acta, Vol 121, p 197-203, December, 1980. 3 Fig, 4 Tab, 12 Ref.

Descriptors: *Waste water, *Phosphorus compounds, *Water analysis, Phosphorus, Phosphates, Spectrometry, Analytical techniques, *Pollutant identification.

Total phosphorus in waste waters was determined by inductively-coupled plasma-atomic emission spectrometry. The detection limits were 0.02, 0.04, and 0.11 micrograms per ml at the 213.618, 214.914, and 253.565 nanometer lines, respectively. Some interference was experienced with copper, but the following materials had negligible or small effect on the phosphorus determination at concentrations similar to those in waste water: Na, K, Ca, Mg, Cl, Al, Mn, Si, Ti, nitrate, sulfate, ammonium, dextrose and tartaric acid. Comparison of practical waste water samples analyzed by a standard method, the persulfate digestion-colorimetric method (molybdenum blue with ascorbic acid), and the method described in this paper showed good agreement between the methods. (Cassar-FRC)
W81-01611

AN EVALUATION OF DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY AT A ROTATING GLASSY CARBON ELECTRODE FOR THE DETERMINATION OF CADMIUM, COPPER, LEAD AND ZINC IN ANTARCTIC SNOW SAMPLES,
British Antarctic Survey, London (England).
M. P. Landy.
Analytica Chimica Acta, Vol 121, p 39-49, December, 1980. 1 Fig, 5 Tab, 25 Ref.

Descriptors: *Antarctica, *Metals, *Snow, *Path of pollutants, *Trace elements, Cadmium, Copper, Lead, Zinc, Analytical techniques, Water pollution sources, Adelaide Island, Polar regions.

Metals at sub ppb concentrations in Antarctic snow samples were determined without preconcentration by adapting differential pulse anodic stripping voltammetry at a rotating glassy electrode. In situ mercury plating gave better results than a permanent mercury film. Ultrapure water and rigorously cleaned vessels were essential. Low pH was maintained because under this condition the metals were more 'electrochemically available' and the rate of adsorption of metals onto the container was minimized. Samples of snow were collected on Adelaide Island to determine the relationship between metal concentration and source (a British base, the sea, and rock exposures). Zinc samples were taken, but container contamination caused results to be inconclusive. Levels of Cd, Cu, and Pb, averaged 0.37 + or - 0.30, less than 0.47 + or - 0.47, and 0.82 + or - 0.65 respectively on samples taken on a 30.9 km traverse north from the base. Samples 52 km from the base averaged about 0.10, suggesting anthropogenic origin. On a 14.4 km traverse from the sea, levels of Cd, Cu, and Pb (0.14 + or - 0.2, less than 0.08 + or - 0.11, and 0.20 + or - 0.24, respectively) approached the sample background level for remote areas. Metal content of snow samples taken near exposed rock indicated that local geology and wind direction and strength strongly affected metal distribution. (Cassar-FRC)
W81-01612

THE DETERMINATION OF ARSENIC BY ELECTROTHERMAL ATOMIC ABSORPTION SPECTROMETRY WITH A GRAPHITE FURNACE, PART 2. DETERMINATION OF ARSENIC(III) AND ARSENIC(V) AFTER EXTRACTION,
Antwerp Univ., Wilrijk (Belgium). Dept. of Chemistry.
D. Chakraborti, W. DeJonghe, and F. Adams.
Analytica Chimica Acta, Vol 120, p 121-127, November, 1980. 1 Fig, 3 Tab, 22 Ref.

Descriptors: *Arsenic compounds, *Analytical techniques, Pollutant identification, Water analysis, *Spectroscopy, Natural waters, Instrumentation.

Arsenite and arsenate can be sequentially determined in fresh and sea water samples by extraction and atomic absorption spectrometry. This method shows recoveries of greater than 90% and has a detection limit of 6 ng per liter. A 500 or 1000 ml sample is extracted with HCl and ammonium butyl dithiophosphate-hexane solution. Arsenic(3+) is then present in the organic layer; arsenic(5+), in the aqueous layer. After treatment of the aqueous layer with a reducing agent, sodium hydrogen sulfite-sodium thiosulfate solution, the previous extraction procedure is used and the now-reduced arsenic(5+) obtained in the organic layer. The latter is extracted with bromine water and reacted with nitric acid, hydrogen peroxide, and nickel sulfate solution. Samples are compared with stand-

ards using graphite furnace atomic absorption spectrometry. Interference from K, Al, Na, SO4, and other cations and anions is eliminated using this extraction reagent. (Cassar-FRC)
W81-01613

CHEMICAL SPECIATION OF MERCURY IN NATURAL WATERS,
National Water Research Inst., Burlington (Ontario).
P. D. Goulden, and D. H. J. Anthony.
Analytica Chimica Acta, Vol 120, p 129-139, November, 1980. 4 Fig, 3 Tab, 9 Ref.

Descriptors: *Mercury, *Water analysis, Analytical techniques, *Pollutant identification, Chemical properties, Path of pollutants, *Speciation, Ecosystems.

Speciation of mercury forms in environmental samples is of interest in order to determine the routes by which mercury passes through the ecosystem and because of the differing toxicities of the varying forms. Three species of mercury (inorganic, aryl mercury compounds, and alkyl mercury compounds) can be differentiated and determined in natural waters by improving the sensitivity of the cold vapor atomic absorption method. The detection limit has been lowered from 0.001 micrograms per liter to 1 nanogram per liter by partitioning at 90C and measuring absorbance at room temperature. Total mercury is determined in the mechanized system by digesting the sample, first to inorganic mercury, then to elemental mercury, which is measured by absorbance. Speciation is accomplished by treating with reducing agents; EDTA-water with hydroxylamine in alkaline solution reduces inorganic compounds to mercury; and CdCl2 and SnCl2 reduces all forms to mercury. (Cassar-FRC)
W81-01614

GAS CHROMATOGRAPHIC METHOD FOR THE DETERMINATION OF SELENITE AND TOTAL SELENIUM IN SEA WATER,
Southampton Univ. (England). Dept. of Oceanography.
C. I. Measures, and J. D. Burton.
Analytica Chimica Acta, Vol 120, p 177-186, November, 1980. 3 Fig, 6 Tab, 21 Ref.

Descriptors: *Selenium, *Sea water, *Pollutant identification, Analytical techniques, Water analysis, *Gas chromatography, Chemical properties

A method for routine determination of selenite and total selenium in sea water uses oxidation under controlled pH, extraction with toluene, and gas chromatography with an electron capture detector. Selenite reacts with 4-nitro-o-phenylenediamine at pH less than 1.8 to form 5-nitropiazselenol. A single toluene extraction yielded 80% recovery. Therefore, standards are prepared from known selenium solutions. Total selenium is determined by photo-oxidation of the sample, which has been mixed with borax and hydrogen peroxide. After this step, the selenite oxidation procedure converts the remainder of the selenium to the piazselenol. None of the ions studied (nitrate, nitrite, phosphate, silica, V(5+), Cr(3+), Cr(6+), Mn(2+), or Mn(4+)) interfered at concentrations 10 to 100 times normal sea water levels. Detection limit for this method is 10 pmol per liter. (Cassar-FRC)
W81-01615

AUTOMATIC DETERMINATION OF INORGANIC CARBON IN SURFACE WATERS,
Ontario Ministry of the Environment, Rexdale.
J. Crowther, and W. B. Moody.
Analytical Chimica Acta, Vol 120, p 305-311, November, 1980. 2 Fig, 2 Tab, 5 Ref.

Descriptors: *Carbon dioxide, *Acidic water, *Pollutant identification, Analytical techniques, Carbon, *Inorganic carbon, Acidity, Surface waters, Chemistry of precipitation, Water sources, Colorimetry.

An automated colorimetric procedure was developed for determination of dissolved inorganic carbon equilibria products in waters. This method, useful in studies of acid rains and waters, can handle concentrations in high and low ranges, 0.3-40.0 mg per liter and 0.01 to 2.00 mg per liter. For the high analytical range the sample was acidified to convert products to carbon dioxide. Then the stream was mixed with CO2-free air, passed over a gas dialyzer with a CO2-permeable membrane. Carbon was determined by measuring the loss in absorbance in a weakly buffered alkaline phenolphthalein solution at 550 nm. For the low range of concentration, an extra gas dialyzer and heating bath set at 60C were added and flow rates changed. Results are valid if samples are protected from the atmosphere. Interferences were limited to sulfide, which was detected as inorganic carbon. Eight common cations and 7 common anions, humic acid, and tannic acid did not interfere. (Cassar-FRC)
W81-01617

DETERMINATION OF TRACES OF PHENOL IN WATERS BY MOLECULAR EMISSION CAVITY ANALYSIS,
Ibadan Univ. (Nigeria). Dept. of Chemistry.
O. Osibanjo, and S. O. Ajayi.
Analytica Chimica Acta, Vol 120, p 371-375, November, 1980. 1 Fig, 3 Tab, 16 Ref.

Descriptors: *Phenols, *Analytical techniques, Aromatic compounds, *Pollutant identification, Water analysis, Molecular emission cavity analysis, Atomic absorption-emission spectroscopy.

Traces of phenol were determined in natural waters by adapting a flame atomic absorption/emission spectrophotmeter for molecular emission cavity analysis. The equipment was modified by assembling an indium-coated steel cavity. Water samples were treated with acetic acid and liquid bromine to form the tribromo derivative. This precipitate was dissolved in ethanol, injected into the cavity, and the InBr emission obtained on igniting the flame measured at 376 nm. A graph was prepared for phenol over the range 0.000005 to 0.00015 moles. Although the low levels of chloride, iodide, nitrate, sulfate, and phosphate ions found in surface waters do not interfere with the determination, high levels of phosphate, chloride, and iodide should be previously removed with silver sulfate. Nitrate can be reduced to nitrite and removed with sulfamic acid. Recoveries of 98% phenol were obtained using this method to analyze lake waters. (Cassar-FRC)
W81-01618

MOLECULAR EMISSION CAVITY ANALYSIS, PART 18. DETERMINATION OF SOLUBLE SULPHATE IN WATERS, SOIL, DUSTS, AND OTHER SAMPLES,
Birmingham Univ. (England). Dept. of Chemistry.
T. S. Al-Ghabsha, S. L. Bogdanski, and A. Townshend.
Analytica Chimica Acta, Vol 120, p 383-387, November, 1980. 3 Tab, 11 Ref.

Descriptors: *Sulfates, *Water analysis, *Soil analysis, Sulfur compounds, Analytical techniques, *Pollutant identification, Molecular emission cavity analysis, Atomic absorption-emission spectroscopy.

Water-soluble sulfates in samples of water, soil, and dusts were determined by a simple, quick, accurate method which does not involve precipitation. After digestion of the sample in water, the particulates were filtered out and the water concentrated by boiling. After addition of phosphoric acid, the solution was injected into a cold stainless steel cavity for measurement by molecular emission cavity analysis. Emission intensity at 384 nm was recorded as a function of time. Comparison with nephelometric and gravimetric methods showed good agreement. (Cassar-FRC)
W81-01619

DETERMINATION OF CYANIDE IN THE PRESENCE OF MERCAPTANS WITH A SELECTIVE-ELECTRODE,
Pardo de la Magdelena, Valladolid (Spain). Dept. of Analytical Chemistry.
J. L. Bernal, R. Pardo, and J. M. Rodriguez.
Analytica Chimica Acta, Vol 120, p 367-370, November, 1980. 2 Tab, 10 Ref.

Descriptors: *Cyanide, *Sulfur compounds, *Mercaptans, Water analysis, Analytical techniques, Waste water, Industrial wastes, *Pollutant identification, Electrometry, Ion-selective electrodes.

Interference of mercaptans in determination of cyanide in waste waters by the cyanide-selective electrode is eliminated by oxidation or oxidation-distillation treatments. The oxidation method, which detects only free cyanide, uses TISAB solution and hydrogen peroxide prior to electrode determination of cyanide ion. The oxidation-distillation method, which breaks down complexes and detects total cyanide ion, follows the oxidation treatment with addition of mercuric chloride, magnesium chloride, and sulfuric acid and distillation of hydrogen cyanide for a period of 50 minutes. Cyanide ion is determined with the electrode as before. (Cassar-FRC)
W81-01620

AN IMPROVED FLOW INJECTION DETERMINATION OF NITRITE IN WATERS BY USING INTERMITTENT FLOWS,
Centro de Energia Nuclear na Agricultura, Sao Paulo (Brazil).
E. A. G. Zagatto, A. O. Jacintho, J. Mortatti, and H. Bergamin.
Analytica Chimica Acta, Vol 120, p 399-403, November, 1980. 3 Fig, 1 Tab, 9 Ref.

Descriptors: *Nitrites, *Waste water, *Water analysis, Nitrogen compounds, Analytical techniques, *Pollutant identification, Instrumentation, Flow injection analysis, Spectroscopy.

A routine spectrophotometric method for determination of nitrites in waste waters uses an injector-commutator with a 0:1:2 section, which achieves intermittent flows without intermittent pumping. The merging zones approach is used to reduce consumption of reagents. With this method, 70 samples can be run hourly compared with 55 samples per hour without intermittent flow. Precision is 0.5% relative to a 60 ppb nitrite water sample. (Cassar-FRC)
W81-01621

A SIMPLE AND RAPID METHOD OF COLLECTING RADIONUCLIDES FROM RAIN WATER,
Chemical Analysis Center, Chiba (Japan).
T. Kimura, and T. Hamada.
Analytica Chimica Acta, Vol 120, p 419-422, November, 1980. 1 Fig, 2 Tab, 4 Ref.

Descriptors: *Rain water, *Strontium radioisotopes, Radionuclides, Water analysis, Fallout, *Radioisotopes, Nuclear explosions, Ion exchange resins, Sampling, Gamma rays, Pollution.

Radionuclides in rain water were concentrated by passing 10-liter samples through ion exchange resin columns. One method involved filtering the rain water sample, passing the filtrate through the resin column, evaporating the effluent to about 15 ml, and determining the gamma-emitters in filter, resin, and effluent by X-ray spectrometry. A second method used Powdex ion exchange resin treated with precoating material. Strontium solution was added to the sample as a carrier. After elution, radiostrontium was measured with a beta-ray spectrometer and total strontium by atomic absorption spectrometry. In Method 1, Zr95, Ce141, and Ce144 were collected on the filter paper; Be7 and Cs137 on the resin. A little Zr95, Ba140, and Ce144 were found in the effluent. In Method 2 almost all the gamma-emitters were found in the resin, little in the effluent. Recovery of strontium ions from the resin ranged between 75-90%. (Cassar-FRC)
W81-01622

QUANTITATIVE DETERMINATION OF MIREX AND ITS DEGRADATION PRODUCTS BY HIGH-RESOLUTION CAPILLARY GAS

Group 5A—Identification Of Pollutants

CHROMATOGRAPHY/MASS SPECTROMETRY,
Canada Centre for Inland Waters, Burlington (Ontario).
F. I. Onuska, M. E. Comba, and J. A. Coburn.
Analytical Chemistry, Vol 52, No 14, p 2272-2275, December, 1980. 3 Fig, 4 Tab, 10 Ref.

Descriptors: *Mirex, *Analytical techniques, *Pollutant identification, *Pesticide residues, Fish, Trout, Aquatic animals, Lampreys, Gas chromatography, Mass spectrometry, Lake Ontario, Niagara River.

Mirex and its environmental degradation products in samples of fish and suspended sediments from Lake Ontario and the Niagara River were determined by mass spectrometry using their electron impact ionization mass spectra. These results were compared with analysis by electron capture gas chromatography. Single ion monitoring for the selected ions m/z 546 and m/z 272 and multiple ion detection using four preselected ions showed insignificant statistical differences when compared with each other and the gas chromatography method. The single ion detection procedure monitoring ion m/z 272 was suggested as a rapid, sensitive method for determination of mirex. Ten trout samples contained between 75 and 330 picograms per microliter. Five lamprey samples averaged 14-17 picograms per microliter; the two sediment samples, 268 and 755 picograms per liter. (Cassar-FRC)
W81-01623

DETERMINATION OF TRACE ELEMENTS IN SEA WATER BY INDUCTIVELY-COUPLED PLASMA EMISSION SPECTROMETRY,
Takaishi City Environmental Pollution Control Center, Osaka (Japan).
A. Sugimae.
Analytica Chimica Acta, Vol 121, p 331-336, December, 1980. 3 Tab, 16 Ref.

Descriptors: *Trace elements, *Sea water, *Water analysis, Metals, *Pollutant identification, Analytical techniques, Lead, Manganese, Cadmium, Nickel, Zinc, Iron, Vanadium, Copper, *Spectrophotometry, Atomic absorption-emission.

Inductively-coupled plasma emission spectrometry has been applied to detection of trace elements in sea water without interference from the high levels of Na, Mg, and Ca present. Complexes of the trace metals (Pb, Zn, Cd, Ni, Mn, Fe, V, and Cu) with sodium diethyldithiocarbamate are extracted with chloroform. Before nebulization, the extract is evaporated to dryness, treated with hydrochloric acid and nitric acid, evaporated again, and dissolved in distilled water. Recoveries of trace elements examined were 97-99%, with the exception of V (83 + or - 5%). Detection limits for one-liter samples in micrograms per liter are as follows: Mn, 0.063; Zn, 0.13; Cd, 0.25; Fe, 0.25; V, 0.38; Ni, 0.5; Cu, 0.5; and Pb, 2.5. (Cassar-FRC)
W81-01624

PURGE VESSEL DESIGN IN DETERMINATIONS OF VOLATILE ORGANIC COMPOUNDS,
Dow Chemical Co., Midland, MI.
T. Ramstad, and T. J. Nestrick.
Analytica Chimica Acta, Vol 121, p 345-348, December, 1980. 1 Fig, 3 Ref.

Descriptors: *Organic compounds, *Water analysis, *Purge vessels, Volatile organics, Instrumentation, Waste water, *Pollutant identification, Volatility.

Five purge vessels for determination of volatile organic compounds in aqueous systems are described and illustrated. The Bellar and Lichtenberg (B and L) vessel is waterjacketed and fitted with an antifoam device. Sample capacity is 10 cu cm. Detection limits are sub ppb. The Mini B and L is useful where sample size is limited, where shortened purge time is important, and in analysis of industrial waste streams. The Mini B and L with foam trap is useful for samples 1.5 cu cm or less which foam. The packed purge vessel completely suppresses servere foaming and supplies high purging efficiency. The particulate purge vessel can determine volatile organics in sediments, soils, and sludges. (Cassar-FRC)
W81-01625

THE D.C. POLAROGRAPHIC DETERMINATION OF TRACES OF HUMIC SUBSTANCES IN POTABLE WATERS (SPURENANALYSE VON HUMINSTOFFEN IM TRINKWASSER),
Academie der Wissenschaften der DDR, Leipzig. Forschungsstelle fuer Chemische Toxikologie.
H. Sohr, and K. Wienhold.
Analytica Chimica Acta, Vol 121, p 309-314, December, 1980. 3 Fig, 9 Ref. (English summary).

Descriptors: *Humic acids, *Potable water, *Fulvic acids, Organic acids, Analytical techniques, Water analysis, *Pollutant identification, Polarography.

Humic substances reduce the inhibitory effect of a tri-n-butylphosphate layer absorbed at the mercury drop on the polarographic wave of copper (II). This effect can be used to measure humic substances in drinking water in the range 0.05 to 1 mg per liter. This method does not differentiate between humic and fulvic acids. Amino acids, peptides, and polyhydroxy compounds do not interfere. A reference compound isolated from peat bog water was used. (Cassar-FRC)
W81-01626

SAMPLING: DEFINING THE TASK AND PLANNING THE SCHEME,
Water Research Centre, Marlow (England). Medmenham Lab.
For primary bibliographic entry see Field 7A.
W81-01627

SAMPLING OF WATER AND WASTE WATER: PRACTICAL ASPECTS OF SAMPLE COLLECTION,
Severn-trent Water Authority (England). Avon Div.
T. Schofield.
Water Pollution Control, Vol 79, No 4, p 468-476, November, 1980. 1 Tab, 4 Ref, Append.

Descriptors: Sampling, *Water sampling, *Water pollution, *Water quality, Data collections, Monitoring, Measurement, Equipment, Waste water(Pollution), Streamflow, Flow rates, *Water analysis, Methodology.

Practical suggestions for reliable collection of water and waste water samples are discussed. A thorough understanding of the system and sites (continuous vs. batch, two-phase liquids, changes in river flow, etc.) is necessary for effective sample collection. The nature of discrete and composite samples is described. Composite samples may include time-interval, flow-proportional, sequential, and continuous. Proper sample size, handling, labeling, and preservation of stability are emphasized. Automatic sampling methods are briefly discussed. Properties and advantages of commercial instruments available for automatic sampling are compared in a table. (Cassar-FRC)
W81-01628

5B. Sources Of Pollution

INVESTIGATION INTO EFFLUENT DISCHARGES FROM WASHINGTON FRESH APPLE PACKERS, VOLUMES I AND II,
SCS Engineers, Long Beach, CA.
J. Vuceta, R. Marsh, K. LaConde, and T. Dong.
Report, September 17, 1980. Vol 1 - 110 p, Vol 2 - 82 p, 23 Fig, 16 Tab, 153 Ref, 4 Append. EPA 68-03-2578.

Descriptors: *Washington, *Pre-treatment(Water), *Water sampling, *Adsorption, *Apples, Orchards, Laboratory tests, Chemical degradation, Chemical properties, Biomass, Activated sludge, Filtration, Groundwater, Apple packing industry, Effluents, Storage, Preservation, Chemicals.

Disposal practices and pretreatment technology were investigated for four chemicals---diphenylamine (DPA), sodium orthophenylphenate (SOPP), benomyl, and thiabendazole (TBZ)---utilized by Washington State fresh apple packers. Samples of effluent streams, in-process batch solutions, and groundwater were analyzed. A laboratory-scale activated sludge (AS) unit was used to evaluate each chemical. Carbon adsorption, coagulation, filtration, ion exchange, and chemical pretreatment technologies were evaluated. Theoretical degradation products of all four chemicals were assessed. DPA upset the AS unit under slug load conditions at 100 ppm. None of the other chemicals exhibited toxic effects. Activated carbon adsorption appeared to be the most effective pretreatment technology in terms of removal efficiencies; mixed-media filtration, the least effective. Very little published information was found relative to degradation products of DPA and SOPP, while the published information on benomyl and TBZ was found to be more extensive. The possible degradation pathways of each were thus developed, based also on their similarity with other applicable organics. It was concluded that the catabolic and metabolic pathways of all four chemicals are not well understood. Volume II, the appendices, contains detailed descriptions of the analytical techniques used during this study. (Author's abstract)
W81-01431

STATE OF WASHINGTON INDUSTRIAL WASTE SURVEY.
URS Co., Seattle, WA.
For primary bibliographic entry see Field 5D.
W81-01434

IMPACT OF URBAN STORM RUNOFF ON STREAM QUALITY NEAR ATLANTA, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
J. B. McConnell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142473, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-094, August 1980. 64 p, 11 Fig, 15 Tab, 13 Ref. EPA-IAG-D6-0137.

Descriptors: *Urban runoff, *Storm water, *Streams, *Water quality, Storm runoff, Thunderstorms, Dry seasons, Water pollution, Georgia, Summer, Autumn, Coliforms, Biochemical oxygen demand, Dissolved oxygen, Trace elements, Waste treatment, Low flow, Reservoir releases, Atlanta area(GA).

The objective of this study was to assess the impact of stormwater runoff from point and nonpoint sources on the water quality of receiving streams in the Atlanta area. Emphasis was placed on the collection of water-quality data in the summer and autumn to determine the impact on streams from runoff produced by thunderstorms during the dry-weather seasons. Compared to dry-weather flow, stormwater runoff significantly increased the average concentration of suspended sediment, BOD 5, total organic carbon, total ammonia nitrogen, total phosphorus, fecal coliform bacteria, and trace metals in most receiving streams in the Atlanta Metropolitan Area. Stormwater runoff increased the mean concentration of most constituents 2- to 5-fold. In most streams, the dissolved-oxygen concentrations generally increased to near saturation during periods of stormwater runoff. The dissolved-oxygen concentration in the Chattahoochee River near Fairburn during a period of low flow reached a low of 1.5 milligrams per liter (a 4-milligram per liter decrease) as a result of runoff from a July thunderstorm. However, low flow during the summer and autumn occurs only about 21% of the time due to flow regulation of the river. The flushing and dilution effect of water released for power generation caused a significant improvement in Chattahoochee River quality most of the time. (Author's abstract)
W81-01439

PHYSICAL CHEMISTRY OF VIRUS ADSORPTION AND DEGRADATION ON INORGANIC SURFACES: ITS RELATION TO WASTE WATER TREATMENT,
Stanford Univ., CA.
J. P. Murray.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112872, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-134, August, 1980. 78 p, 14 Fig, 16 Tab, 78 Ref. R-805016.

Descriptors: *Viruses, *Adsorption, *Waste water treatment, *Physicochemical properties, Aluminum, Chemical properties, Theoretical analysis, Chemical degradation, Disinfection, Environmental sanitation, Water treatment, Public health.

Using poliovirus type 1 as a model enterovirus, it was established with a wide range of materials that adsorption is controlled by the balance between electrostatic double layer interactions and electrodynamic Van der Waals interactions. This control was demonstrated by showing that adsorption free energies calculated from mass action arguments are in good agreement with adsorption potentials calculated from the DLVO-Lifshitz theory of colloid stability. Since this enterovirus is quite characteristic of enteroviruses in size, geometry, electrokinetic properties, and survival in the environment, these studies should be representative of enteroviruses in general. Some solids, most notably aluminum metal, degrade virus during adsorption. When information gained in mechanism and degradation studies was applied to a bench scale system with a 1 cm bed of aluminum and 0.7 min residence time, it was found that aluminum metal removes more than 99% of the input virus titer from secondary effluent at steady-state. Aluminum metal is substantially more effective than granular activated carbon for the purpose of virus removal, and has good potential for eventual use in advanced water and waste water treatment systems. The DLVO-Lifshitz theory provides a fundamental, organized frame of reference in which to understand virus adsorption, and allows prediction of the types of materials and solution conditions conducive to virus adsorption and those that are not. (Moore-SRC)
W81-01441

AN EVALUATION OF NONPOINT SOURCES OF PESTICIDE POLLUTION IN RUNOFF,
North Carolina State Univ. at Raleigh. Dept. of Crop Science.
J. B. Weber, P. J. Shea, and H. J. Strek.
In: Environmental Impact of Nonpoint Source Pollution, 1980, p 69-98. 4 Tab, 51 Ref. Ann Arbor Science Publishers Inc., Ann Arbor, Michigan. OWRT-B-122-NC(4).

Descriptors: *Agricultural runoff, *Rainfall-runoff relationships, *Pesticide drift, Research priorities, *Agricultural chemicals, Rainfall intensity, Runoff, Agriculture, Surface runoff, Surface waters, Pesticides, Planning, Evaluation, Chemicals, Chlorinated hydrocarbon pesticides, Pesticide removal, Poisons, Toxins, Rain, Hazards, Deposition(Pesticides), Residues, Research and development, *Path of pollutants.

The amount of field-applied pesticide runoff into streams depends primarily upon the intensity and duration of rainfall, and the length of time between pesticide application and rainfall occurrence. The objectives of this study were to (1) evaluate the amounts and hazards of pesticides in runoff from agricultural lands, and (2) discuss and evaluate the types of research being carried out to measure this phenomenon. In spite of efforts to measure, model, and modify pesticide runoff from agricultural lands, few new practical developments have resulted since the inception of soil conservation practices recommended over 40 years ago. Pesticide losses to agricultural runoff in long-term studies average 1-2%; while losses under the most 'castastrophic' rainfall condtions averaged about 7% - values comparable to fertilizer nutrient losses in runoff. Hence, sound soil management and conservation practices are applicable for controlling pesticide runoff. Nonetheless, owing to the increased disposal of municipal sludges on agricultrual lands, the use of models to study/predict toxic sludge chemical runoff is encouraged. (Zielinski-IPA)
W81-01474

FATE OF POLYCHLORINATED BIPHENYLS (PCBS) IN SOIL-PLANT SYSTEMS,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
D. Pal, J. B. Weber, and M. R. Overcash.
Residue Reviews, Vol 74, p 45-98, 1980, 20 Fig, 14 Tab, 79 Ref. OWRT-B-122-NC(3).

Descriptors: *Polychlorinated biphenyls, *Soil-water-plant relationships, *Pesticide residues, *Path of pollutants, *Chemical degradation, Chemical analysis, PCB, Aroclors, Chlorinated hydrocarbon pesticides, Pollutant indentification, Pollutants, Soil chemistry, Soil contamination, Soil science, Environment, Environmental control, Soil dynamics, Plant physiology, Hazards, Deposition(Pesticides), Residues, Research and development, Kinetics, Public Health.

This review has evaluated the decomposition and stability of PCBs in soil-plant environments. Assessment was made of the phenomena of plant uptake and accumulation of PCBs, under various growth conditions, and their metabolites in the different parts of plants. Specifically highlighted were the problems of agronomic implications and practices in a society where waste PCBs may be managed by land application at assimilative rates that are safe and economically acceptable. Factors influencing the behavior and fate of PCBs in soils and in crops of agronomic importance have been developed, and a conceptual flow diagram is presented. PCBs decompose in soil system, probably faster than in any other waste management alternative or receiver system involving biological activity. Four areas for future research were identified based on observed major drawbacks in existing data: (1) study of properties of individual PCBs instead of commercial preparations; (2) crop/soil studies with PCBs having four or more chlorine atoms; (3) need for partition coefficient data (soil-water; water-air; air-plant; during flow in the food chain); (4) need for reliable data (e.g., volatization, photodecomposition and water-related transport). (Zielinski-IPA)
W81-01475

A SURVEY OF PATHOGEN SURVIVAL DURING MUNICIPAL SOLID WASTE AND MANURE TREATMENT PROCESSES,
Ebon Research Systems, Washington, DC.
S. A. Ware.
Environmental Protection Agency Report EPA-600/8-80-034, August, 1980. 115 p, 13 Fig, 26 Tab, 121 Ref. 2 Append. 68-03-2460-5.

Descriptors: *Municipal wastes, *Farm wastes, *Waste treatment, Pathogenic fungi, *Pathogenic bacteria, Animal parasites, Viruses, Water pollution sources, Microorganisms, Public Health, Solid wastes, Environmental sanitation, Incineration, Landfills, Anaerobic digestion, Composting.

Municipal solid waste (MSW) and animal manure may contain microorganisms that cause disease in man and animals. These pathogenic microorganisms include enteric bacteria, fungi, viruses, and human and animal parasites. Composting appears to be an effective method of destroying pathogenic organisms provided that sufficient times and temperatures are achieved. The extent to which microorganisms are destroyed during incineration is a function of both the design and the manner of operation of the incinerator. All pathogens should be destroyed provided that the entire solid waste charge quickly reaches an appropriate temperature. There is a possibility that pathogenic bacteria and viruses may survive conditions within sanitary landfills, and may be leached to ground or surface water. There appears to be a significant decrease in viral and bacterial content of leachate with time of operation or leaching of the fill. The chemical and physical characteristics of the leachate also contribute toward both viral and bacterial inactivation. No studies were available on pathogen survival in anaerobically digested MSW, but studies of digested sewage sludge have shown survival of pathogenic organisms. It appears that prolonged survival of some of the more common pathogens present in animal wastes is possible within the oxidation ditch environment. High gradient magnetic separation and gama radiation sterilization are future options, especially for animal waste management. (Moore-SRC)
W81-01483

A REMOTE SENSING TECHNIQUE TO MONITOR CLADOPHORA IN THE GREAT LAKES,
Environmental Research Inst. of Michigan, Ann Arbor.
For primary bibliographic entry see Field 7B.
W81-01486

ENVIRONMENTAL EFFECTS OF WESTERN COAL COMBUSTION: PART III-THE WATER QUALITY OF ROSEBUD CREEK, MONTANA,
Colorado State Univ., Fort Collins. Dept. of Chemistry.
R. K. Skogerboe, M. M. Miller, D. L. Dick, R. V. Thurston, and R. C. Russo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113615, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-071, July, 1980. 68 p, 23 Fig, 9 Tab, 38 Ref. R803950.

Descriptors: *Water quality, *Air pollution, *Powerplants, Smoke, *Snowmelt, Streams, *Coal, Montana, Arsenic, Mercury, Coal mines, Runoff, Heavy metals, Water pollution, Sediments, Chemical precipitation, Alkaline water, *Rosebud Creek(MT).

Rosebud Creek is the major surface drainage immediately east of the powerplant at Colstrip, Montana. This study was begun in October of 1975, about two months before initiation of power generation at this site, and continued through the spring of 1978. Although coal mining and power generation occur at Colstrip, the effects of mining on water quality have not been detected in creeks having headwaters in the mine area. Influxes of arsenic, mercury, and polynuclear aromatic compounds occurring during snowmelt periods have been linked to scavenging of those contaminants from the plume of the power plant. Snow cover tends to accumulate plume constituents, therby semi-isolating them from the soil and terrestrial biota so that both are denied the extent of contaminant accumulation operative during warmer months. Soluble contaminants accumulating throughout the watershed may consequently be delivered to the stream via the surface runoff associated with snowmelt. Influxes of contaminants delivered intermittently to surface streams via this general route are likely to accumulate in sediments due to normal sedimentation processes and the generally alkaline characteristics of streams in this region which will enhance precipitation of heavy metals. Examination of the Rosebud Creek water quality data for the period of this study indicates that the average concentrations of constituents are at levels considered safe for maintenance of aquatic life. (Moore-SRC)
W81-01489

COMMENT ON 'A NEW COLLOCATION METHOD FOR THE SOLUTION OF THE CONVECTION-DOMINATED TRANSPORT EQUATION' BY GEORGE E. PINDER AND ALLEN SHAPIRO,
Geological Survey, NSTL Station, MS. Water Resources Div.
H. E. Jobson.
Water Resources Research, Vol 16, No 6, p 1135-1136, December, 1980. 3 Fig, 2 Ref.

Descriptors: *Lagrange equation, *Eulerian equation, Dispersion, Equations, *Diffusion, Convection, Mixing, *Transport equation.

The author presents calculations supporting his opinion that the Lagrangian reference frame is superior to the Eulerian for obtaining numerical solutions to the 1-dimensional transport equation.

He claims that the Lagrangian solution is easy to understand, cheap to execute on a computer (1.28 seconds maximum time), stable, and offers a framework from which meaningful information about rate coefficients for transport of nonconservative substances can be estimated. (Cassar-FRC)
W81-01514

PICLORAM IN WATER AND SOIL FROM A SEMIARID PINYON-JUNIPER WATERSHED,
Science and Education Administration, Tucson, AZ.
For primary bibliographic entry see Field 5A.
W81-01521

A WATERSHED STUDY OF GLYPHOSATE TRANSPORT IN RUNOFF,
Science and Education Administration, Coshocton, OH. North Appalachian Experimental Watershed.
W. M. Edwards, G. B. Triplett, Jr., and R. M. Kramer.
Journal of Environmental Quality, Vol 9, No 4, p 661-665, October/December, 1980. 5 Tab, 18 Ref.

Descriptors: *Runoff, *Agricultural runoff, *Herbicides, Rainfall-runoff relationships, Storm runoff, Surface runoff, Erosion, Water pollution control, Watersheds, On-site studies, *Path of pollutants.

The persistence of glyphosate in the soil and its presence in runoff water from field-sized watersheds where it had been used as an herbicide in the production of no-tillage corn and in the establishment of fescue pastures without tillage were evaluated. Each significant runoff event during the growing season was sampled. During the three year study the greatest transport of glyphosate in runoff from any watershed was 165 g/ha, or 1.85% of the amount applied. Most of that loss resulted from a single storm occurring 1 day after an abnormally high glyphosate treatment of 8.96 kg/ha had been applied. At all other sample testing times, the runoff was less than 1% of the glyphosate applied. Both the application rate and the time interval between application and cause for runoff influenced the amount of glyphosate in the runoff. Runoff occurring as a result of a long duration, low intensity storm taking place when the ground was already wet had a lower glyphosate concentration than would be otherwise expected. It was concluded that runoff from fields treated with Roundup herbicide (active ingredient, glyphosate) at recommended concentrations would not constitute an environmental hazard. (Baker-FRC)
W81-01522

THE EFFECT OF A MARSH ON RUNOFF: I. A WATER-BUDGET MODEL,
Oak Ridge National Lab., TN.
D. D. Huff, and H. L. Young.
Journal of Environmental Quality, Vol 9, No 4, p 633-640, October-December, 1980. 5 Fig, 4 Tab, 9 Ref.

Descriptors: *Nutrients, Evaporation, Transpiration, Phosphorus, *Hydrologic budget, Transport, *Model studies, Marsh management, *Marshes, Hydrologic data, Groundwater, Surface water, *Path of pollutants.

Field and simulation studies developed to investigate the transport of nutrients in surface and subsurface water flows across a marsh are discussed. Wingra marsh, which is adjacent to Lake Wingra in Madison, Wisconsin, was used for the studies. Monthly totals of evaporation-transpiration, surface runoff, and subsurface drainage were calculated from April 1970 through August 1976. Urban storm runoff accounts for about 90% of the water in the marsh, while 8% comes from precipitation and 2% from deep ground-water inflow. Surface outflow accounts for 85% of the water that leaves the marsh, while evaporation/transpiration accounts for 7% and shallow ground-water discharge for 8%. The water-budget model developed is able to reproduce water-table fluctuations and estimate the correct level within 10 cm during most of the time. In 1970 the model simulations were begun, and a comparison is offered which indicates that the accuracy of the method is adequate for estimating phosphorus inputs to the lake. (Baker-FRC)
W81-01524

THE OXIDATION OF ARSENITE BY AQUATIC SEDIMENTS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
D. W. Oscarson, P. M. Huang, and W. K. Liaw.
Journal of Environmental Quality, Vol 9, No 4, p 700-703, October/December, 1980. 1 Fig, 3 Tab, 33 Ref.

Descriptors: *Chemical reactions, *Sediments, *Arsenic compounds, Agricultural chemicals, Oxidation, Water quality, Sedimentation, Arsenicals, Pesticides, Lake sediments.

The role of freshwater sediments in the oxidation of As(III) to As(V) was studied. Sediments were taken from five lakes, Buffalo Pound, Pasqua, Echo, Mission, and Katepwa, in Saskatchewan, Canada. These lakes drain a large area of the agricultural land in southern Saskatchewan. Composite samples were used for all experiments. The concentration of As(III) and the ratio of As(III) to As(III) + As(V) in solution indicates that all five lake sediments oxidize As(III) within 48 hr. In the absence of sediment, oxidation of As(III) is not detectable within 72 hr. Sorption of As occurred simultaneously with the oxidation of As(III) to As(V). Over 90% of added As was sorbed by sediments within 72 hr, except in the Buffalo Pound sediment. Flushing of nitrogen or air through the sediment suspensions did not influence the oxidation of As(III). Neither was the oxidation influenced by HgCl2. The oxidation is an abiotic process, with microorganisms occupying only a minor role. (Baker-FRC)
W81-01525

MAXIMUM PESTICIDE CONCENTRATIONS IN AGRICULTURAL RUNOFF: A SEMIEMPIRICAL PREDICTION FORMULA,
Southern Weed Science Lab., Stoneville, MS.
R. D. Wauchope, and R. A. Leonard.
Journal of Environmental Quality, Vol 9, No 4, p 665-672, October/December, 1980. 4 Fig, 2 Tab, 36 Ref.

Descriptors: *Model studies, *Agricultural runoff, *Pesticides, Herbicides, Runoff, Agricultural chemicals, Water quality control, Rainfall-runoff relationships.

A simple semiempirical model is described that predicts single event, edge-of-field bulk runoff concentrations of pesticides in terms of factors such as the physical-chemical properties of the compound, the location of the spray deposit after application, the amount of chemical applied on an area basis, and the dissipation and degradation of spray deposits before runoff occurs. The formula which was constructed is based on data culled from the literature concerning concentrations of pesticides observed in runoff waters. While the formula is crude, it should be useful to water quality planners in their attempts to predict worst-case pesticide inputs from agricultural sources. (Baker-FRC)
W81-01526

SEWAGE FARMING IN IRAQ: A POTENTIAL HAZARD FOR POLLUTION,
Environmental Pollution Research Center, Baghdad (Iraq).
For primary bibliographic entry see Field 3C.
W81-01528

EFFECT OF SEWAGE EFFLUENT ON MICROBIAL ACTIVITIES AND COLIFORM POPULATIONS OF PAHOKEE MUCK,
Florida Univ., Belle Glade.
R. L. Tate, III, and R. E. Terry.
Journal of Environmental Quality, Vol 9, No 4, p 673-677, October/December, 1980. 2 Fig, 4 Tab, 19 Ref.

Descriptors: *Sewage effluent, *Organic matter, Muck soils, Microbial degradation, Coliforms, Sewage treatment, *Sewage disposal, Land subsidence, Soil disposal fields.

The effect of sewage effluent was measured on microbial activity in Pahokee muck. Test plots were amended at weekly intervals with sewage effluent at a rate of 5 cm/wk. In general, the indigenous microbial activity of the effluent-amended soil was greater than that of the soil which was water-amended or untreated. An increase in indigenous activity occurred with the addition of the sewage effluent to the soil, and then declined steadily throughout the week between sewage additions. The increase in activity immediately after amendment reflected the biochemical oxygen demand of the effluent. Anaerobic bacterial populations did not differ significantly between the sewage-effluent or water-amended samples or unamended soil plots. However, significant variations were noted for various sample dates, most likely resulting from soil moisture changes. The augmented dehydrogenase activities and generally elevated carbon metabolic rates in amended soils indicate that microbial activity in the muck was stimulated. Coliform bacteria passed through the soil profile, but the increased moisture, not the nutrients, of the sewage effluent stimulated the oxidation of soil organic matter, thereby stimulating soil subsidence. Therefore a sewage disposal plan involving cultivated organic soils must be viewed as a threat to the longevity of the soils. (Baker-FRC)
W81-01529

EXTRACTION, SPECIATION, AND ANALYSIS OF ARSENIC AND ARSENICAL HERBICIDES IN RUNOFF: EVALUATION OF SIMPLE METHODS AT THE PPB LEVEL,
Southern Weed Science Lab., Stoneville, MS. Chemistry Dept.
R. D. Wauchope, and M. Yamamoto.
Journal of Environmental Quality, Vol 9, No 4, p 597-601, October/December, 1980. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Herbicides, *Arsenic, Arsenicals, Arsenic compounds, *Pollutant identification, Gas chromatography, Analytical techniques, Water analysis, Runoff, Path of pollutants.

One of the simplest available techniques of speciation and analysis, column chromatography, was applied to the study of arsenic in runoff mixtures of water and sediment. The method involved the following steps: collection of natural runoff samples, spiking of samples with inorganic arsenic (as arsenate) and DSMA at levels similar to those found in cotton-field runoff, separation of water and sediment, extraction and speciation of added and natural arsenic in sediment and water, and quantification of arsenic in the fractions. The separated arsenic species were quantitated at the ppb level by a flameless atomic absorption technique. The arsenate ion is present in the soils as a natural component. Methanearsonate ions are present in the soil due to the use of sodium (MSMA) and disodium (DSMA) salt forms as herbicides. By this method, recoveries ranged from 80-100%, with the relative precision between samples being 10% for concentrations of arsenic between 10 and 200 ppb. It appeared that the arsenate was much more strongly adsorbed by sediments than was methanearsonate. This technique should be useful in determining whether there are significant species changes when arsenate or methanearsonate enter surface impoundments and in studying sediment-water partitioning of the species. (Baker-FRC)
W81-01530

CONTROLLING THE RATE OF ACID LOSS FROM STRIP MINE SPOIL,
Science and Education Administration, University Park., PA. Northeast Watershed Research Center.
H. B. Pionke, A. S. Rogowski, and R. J. de Angelis.
Journal of Environmental Quality, Vol 9, No 4, p 694-699, October/December, 1980. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Acid streams, *Mine wastes, *Pyrite, Groundwater movement, Mine drainage, Soil

water movement, Acidic water, Water pollution sources, Leaching.

The worsening of groundwater quality especially due to acid products contamination from strip mine spoil is discussed. The experimental design consisted of incubating drained, wetted strip mine spoil in an air or nitrogen atmosphere for various periods of time. When incubation was terminated, the spoil was quickly leached and the leachate was chemically analyzed. The soil material that was used contained substantial concentrations of pyrite (3.8%) and acid products (3.1%). Initial acid losses to groundwater were large if materials were placed deeply, especially when the materials were submerged or frequent flushing occurred. As leaching progressed, diffusion became potentially the limiting factor. Pyrite oxidation in the spoil particle was primarily controlled by either the pyrite oxidation rate or the oxygen diffusion rate. Where oxygen is present in excess and the particle remains water saturated, the initial and subsequent rates of acid production from pyrite will be controlled by the pyrite oxidation rate. When the spoil is deeply submerged, oxygen diffusion is likely to be the limiting factor. The basic particle size is important in controlling rates of salt and acid losses to groundwaters in cases where diffusion is limiting, as this reduces the acid-contributing volumes relative to the total spoil mass. (Baker-FRC)
W81-01531

SOIL POTENTIAL RATINGS FOR SEPTIC TANK ABSORPTION FIELDS IN LEON COUNTY, FLORIDA,
Soil Conservation Service, Lanham, MD.
R. L. Guthrie, and G. J. Latshaw.
Journal of Soil and Water Conservation, Vol 35, No 6, p 278-280, November/December, 1980. 4 Tab, 2 Ref.

Descriptors: *Septic tanks, *Sewage disposal, *Soil disposal fields, Absorption fields, Soil potential index, Land use, Leon County, Florida, Domestic wastes, Percolation, Soil types, Soil properties, Waste disposal, Costs, Estimated costs.

Soil potential ratings were tested in Leon County, Florida, septic tank absorption fields according to the formula, SPI = P - (CM + CL) where SPI = soil potential index, P is index of performance of yield, CM is the index of cost of corrective measures, and CL is the index of costs resulting from continuing limitations. Soil scientists, sanitarians, and contractors worked on different aspects of the soil potential index components in order to calculate reliable figures. A table lists 47 local soils and their SPI. Although all ratings apply only to the local area, this pilot study provides several advantages. Residents have available better information on corrective measures, local regulations, uniformity of procedure, and costs involved. (Cassar-FRC)
W81-01537

BIOLOGICALLY MEDIATED CORROSION AND ITS EFFECTS ON WATER QUALITY IN DISTRIBUTION SYSTEMS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
S. H. Lee, J. T. O'Connor, and S. K. Banerji.
Journal of the American Water Works Association, Vol 72, No 11, Part 1, p 636-645, November, 1980. 11 Fig, 2 Tab, 42 Ref.

Descriptors: *Corrosion, *Microorganisms, *Pipes, Iron, Distribution systems, Water quality, Metals, Bacteria, Water pollution sources, Tubercles.

The corrosion process in pipes was studied in a four-loop pipe system: two polyvinyl chloride pipes with provisions to insert iron test specimens and two steel pipes. Tap water was circulated throughout the system. Within two days 86% of the dissolved oxygen concentration had been depleted in the steel pipe system, 20% in the PVC pipe. Alkalinity and total hardness, which decreased initially in both systems, continued to decrease in the steel pipes. Sulfate ion, pH, ammonium ion, phosphate, and total organic carbon concentrations changed little or were detected in small amounts. Bacteria identified in all systems were iron-precipitating, sulfate-reducing, denitrifying, and stalk-producing organisms. Corrosion rate was highest initially, decreasing to a steady rate. Examination of corroded material showed the presence of the same bacteria seen in the water. Batch corrosion studies were performed using microorganisms isolated from the water. These grew better as a mixed population than as isolated strains. Since weight loss of test specimens was not appreciable, it is believed that microbes promote a localized corrosion of iron through tubercle formation. (Cassar-FRC)
W81-01544

THE OCCURRENCE OF MICROORGANISMS IN WATER MAIN ENCRUSTATIONS,
Environmental Protection Agency, Dallas, TX. Air and Hazardous Materials Div.
M. J. Allen, R. H. Taylor, and E. E. Geldreich.
Journal of the American Water Works Association, Vol 72, No 11, Part 1, p 614-625, November, 1980. 26 Fig, 1 Tab, 13 Ref.

Descriptors: *Microorganisms, *Distribution systems, *Pipes, Corrosion control, Water distribution(Applied), Bacteria, Tubercles, Water pollution sources.

Microorganisms from encrustations or tubercles inside distribution systems were examined by scanning electron microscope. Samples from several locations throughout the U.S. possessed some common characteristics. A multitude of crystal arrays were found beneath a hard, porous surface. Microorganisms were seen at or near the surface of the tubercles, where nutrients and oxygen are continually present. Diatoms and algae were present in pipes from areas which do not use filtration for treatment of surface waters. Actinomycete bacteria were identified in several specimens. By sequential magnification of a porous specimen, organisms were found growing beneath the surface veneer. The presence of these microorganims in the distribution systems does not reflect inadequate treatment, but rather the adaptability of the microbes to their environment. The populations may be decreased by reducing the nutrient and particulate levels and by improving corrosion control. In severe cases, reconditioning or replacing old water mains and eliminating dead ends may be effective. (Cassar-FRC)
W81-01545

BACTERIAL, CHEMICAL, AND MINERALOGICAL CHARACTERISTICS OF TUBERCLES IN DISTRIBUTION PIPELINES,
Ohio State Univ., Columbus. Dept. of Microbiology.
O. H. Tuovinen, K. S. Button, A. Vuorinen, L. Carlson, and D. M. Mair.
Journal of the American Water Works Association, Vol, 72, No 11, Part 1, p 626-635, November, 1980. 5 Fig, 13 Tab, 35 Ref.

Descriptors: *Microorganisms, *Distribution systems, *Pipes, Corrosion control, Iron oxide, Metals, Bacteria, Pollutants, *Columbus(Ohio), Tubercles, Water pollution sources.

Tubercle deposits collected from pipelines in the Columbus, Ohio, water system were examined to characterize bacteria, chemical composition, and minerals present. The complex environment favors a variety of biological and chemical interactions. Many types of bacteria were present: sulfate reducers, nitrate oxidizers, ammonia oxidizers, sulfur oxidizers, and unidentified aerobic heterotrophic bacteria. Filamentous organisms, coliforms and iron oxidizers were not detected. Iron oxide was the major constituent of tubercles, with Ca, Mg, Al, and Mn present at high levels. All samples contained humic material of varying degrees of polymerization, mostly on the surface of the tubercle or in pits on the pipe surface. Corrosion studies showed that pitting, not uniform corrosion, was the predominant form. Tubercles generally had hard crusty exteriors, where chloride and sulfur had a tendency to accumulate, and fluid-like interiors which dried to a powder. The dissolved organic material and bacteria are believed to catalyze iron corrosion. Deteriorating iron pipes can cause release of pathogenic and toxic materials, taste and color problems, increased treatment demands, and loss of hydraulic capacity. (Cassar-FRC)
W81-01546

A MODEL OF THE MEAN FIELD DISTRIBUTION OF A DISSOLVED SUBSTANCE WITHIN THE RIVERINE LAYER OF A FJORD LAKE,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W81-01554

TOWARDS A NITRATE BALANCE FOR ENGLAND AND WALES,
Department of the Environment, Reading (England). Water Data Unit.
T. J. Marsh.
Water Services, Vol 84, No 1016, p 601-606, October, 1980. 6 Fig, 2 Tab, 44 Ref.

Descriptors: *Nitrates, *Fertilizers, *Agricultural runoff, Water pollution sources, *England, *Wales, Nitrogen compounds, Rivers, Water quality, Nitrogen fixation, Path of pollutants, Runoff, Sewage effluents, Waste dilution.

Nitrate levels in lowland rivers in England and Wales are expected to exceed 11.3 mg nitrogen per liter by the mid-1980's. Although sewage effluent and biological fixation contribute some nitrate to the total, agricultural runoff from fertilized lands is the major factor. Since it is unlikely that fertilizer use will decline in the future, it is vital for water suppliers to monitor raw water supplies so that appropriate treatment may be instituted. Results from nitrate sampling at 245 river water monitoring stations show that since 1955 nitrate-nitrogen levels have increased by 44 to 488%. Estimated total nitrate load reaching the tidal limits is 275,000 tons, with 150,000 tons produced by human wastes and 125,000 tons from land runoff. (Cassar-FRC)
W81-01561

A MODEL FOR LAND USE AND WATER QUALITY,
Washington Univ., Seattle. Graduate School of Public Affairs.
For primary bibliographic entry see Field 6A.
W81-01571

DON'T UNDERESTIMATE URBAN RUNOFF PROBLEMS,
Municipal Environmental Research Lab., Cincinnati, OH.
R. Field, and R. Turkeltaub.
Water and Wastes Engineering, Vol 17, No 10, p 48-52, October, 1980. 6 Fig, 3 Tab, 8 Ref.

Descriptors: *Urban runoff, *Storm runoff, *Combined sewers, *Water pollution sources, Organic matter, Dissolved oxygen, Coliforms, Chemicals, Toxicity, Projects, Combined sewer overflow.

While the major emphasis in water pollution control has been on secondary treatment plants, urban stormwater and combined sewer overflow play significant roles in water problems. Only within the past 20 years has it been recognized that runoff contains pollutants picked up from littered streets, dusty roofs, traffic byproducts, hazardous spills, and chemicals used as fertilizers or to control ice. The average BOD of domestic and storm sewer overflow is about one half that of raw sewage, but storm runoff and overflows of great magnitude have a shock loading effect. Forty to 80% of the total organic load entering receiving waters can be caused by runoff. Studies are cited which link dissolved oxygen depletion with urban runoff and excessive fecal coliforms with combined sewer overflow. Toxicity problems can be long-term effect or a short-term emergency; one four-hour storm caused 24,000 gal of oil and grease to bypass New York City's Newtown Creek treatment plant. EPA's Storm and Combined Sewer Research, Development, and Demonstration Program is described. This has as its ultimate goal the control of runoff and combined sewer overflows. (Small-FRC)

W81-01575

HEAVY MINERAL DISTRIBUTION IN BOTTOM SEDIMENTS OF THE BRISTOL CHANNEL, U.K.,
University Coll. of Swansea (Wales). Dept. of Oceanography.
J. V. Barrie.
Estuarine and Coastal Marine Science, Vol 11, No 4, p 369-381, October, 1980.

Descriptors: *Sediments, *Heavy metals, *Channels, Hydraulics, Geologic history, Mineralogy, Bristol channel(UK), United Kingdom, *Bottom sediments.

The influence of channel hydraulics on the light and heavy mineralogy of bottom sediments of the Bristol Channel (United Kingdom) was investigated. Mineral analyses were made of movable noncohesive upper layer benthic sediment. A gradational lateral change in mineralogy was found along the longitudinal axis of the channel, closely following the bathymetric isobaths. The change in mineral composition is coupled with increasing hydraulic inequivalence towards the shallow foreshore zone. Hydraulic equivalence/inequivalence results in selective concentration or dilution of certain minerals. Deviations from standard hydraulic equivalence are indications of distance from source and especially of hydraulic and boundary roughness conditions. Thus, the Holocene transgression within the Bristol channel and the modern hydrodynamic scheme result in the observed heavy mineral distribution. (Small-FRC)
W81-01582

PHOSPHORUS IN SUSPENDED SEDIMENTS OF THE AMAZON RIVER,
Woods Hole Oceanographic Institution, MA.
E. M. Chase, and F. L. Sayles.
Estuarine and Coastal Marine Science, Vol 11, No 4, p 383-391, October, 1980. 1 Fig, 2 Tab, 26 Ref.

Descriptors: *Phosphorus, *Sediments, *Rivers, Estuaries, Soil chemistry, *Suspended sediments, Water chemistry, Algae, Particle size, Mineralogy, Amazon River.

The input of riverborne phosphorus in various particulate forms to the phosphorus budget of the Amazon estuary is evaluated. Samples of Amazon suspended sediments were collected upstream from any tidal influence and analyzed for phosphorus content. Sea water, nitrilotriacetic acid (NTA), K2S2O8, and Na2CO3 fusion extrations were used to determine total flux of phosphorus. Substantial quantities of phosphorus were released from naturally suspended sediments when the sediments were kept in sea water or NTA. Potential availability of phosphorus to algae was estimated at 137 microgram per liter of river water using studies which correlated utilization of sediment phosphorus with freshwater phytoplankton counts. Flux calculations indicate that available particulate phosphorus may be as much as 15 fold greater than dissolved PO4-P (soluble reactive phosphate) during the Amazon rainy season. Dissolved phosphorus would be important only during the dry season. (Small-FRC)
W81-01583

CONCENTRATION AND MICROBIOLOGICAL UTILIZATION OF SMALL ORGANIC MOLECULES IN THE SCHELDT ESTUARY, THE BELGIAN COASTAL ZONE OF THE NORTH SEA AND THE ENGLISH CHANNEL,
Brussels Univ. (Belgium). Lab. of Oceanography.
G. Billen, C. Joiris, J. Wijnant, and G. Gillain.
Estuarine and Coastal Marine Science, Vol 11, No 3, p 279-294, September, 1980. 5 Fig, 4 Tab, 44 Ref.

Descriptors: *Mathematical models, *Microorganisms, *Organic matter, Bacteria, *Estuaries, Oceans, Amino acids, Scheldt estuary, North sea, English Channel.

Concentrations and utilization rates of alanine, aspartate, lysine, glucose, and glycollic, acetic and lactic acids were determined over a seasonal cycle of the water column at three sites: Scheldt estuary, coastal North Sea, and the English Channel. No correlation was observed between the trends of geographical variation of concentration of substrates on one hand, and of utilization rates on the other. Substrate concentrations were not very different at the three sites, while utilization rates differed greatly, with estuarine being the highest, coastal the next highest, and open sea the lowest. A simple model is presented to explain these results. The steady state concentration of a particular substrate is independent of its rate of production and consumption and depends only on physiological characteristics of the bacteria. Using data available in the literature on physiological parameters of marine bacteria, the model accounts for at least the order of magnitude of substrate concentrations observed, and the absence of important seasonal variations. (Small-FRC)
W81-01588

CONTRIBUTION TO THE STUDY ON BOTTOM SEDIMENT IN LAKE BALATON. I. DETERMINATION OF PHOSPHORUS MINERALS IN THE SEDIMENT,
Research Inst. for Water Resources Development, Budapest (Hungary). Inst. for Water Quality Control.
For primary bibliographic entry see Field 2J.
W81-01590

THE DISTRIBUTION OF PELAGIC TARS AND PLASTICS IN THE SOUTH ATLANTIC BIGHT,
South Carolina Wildlife and Marine Resources Dept., Charleston.
R. F. Van Dolah, V. G. Burrell, Jr., and S. B. West.
Marine Pollution Bulletin, Vol 11, No 12, p 352-356, December, 1980. 2 Fig, 2 Tab, 18 Ref.

Descriptors: *Plastics, *Tars, *Oil pollution, Atlantic Ocean, Water pollution sources, Polystyrene beads, Oil wastes, Southeast U.S., Currents(Water), Gulf Stream, Transportation, Ships, Coasts, South Atlantic Bight.

Samples of pelagic tars and plastics were collected by neuston net during six cruises of the R/V Dolphin during 1973-1975 along the Atlantic Coast between 26 and 34 degrees north latitude (Cape Fear, NC. to Cape Canaveral, FL.). Tars were widely distributed throughout the South Atlantic Bight. However, more offshore samples (water depth 200 feet or greater) contained tar, 38.7 to 100%, as compared with near shore samples (water depth less than 200 feet), 26.7 to 72.3%. Tar was detected in a greater percentage of offshore samples during spring than at other times of the year, showing the effect of seasonal currents. Plastic beads, whose distributional patterns were similar to those of tar, were detected in 14.6 to 34.2% of the samples. These results agree with previous work, except that plastic beads were found further south than in the past studies. The authors conclude that the higher incidence of tar and plastic in offshore waters combined with lack of increased concentration of these pollutants near South Atlantic industrial areas indicates that the primary source of contamination is from other areas through entrainment by currents and shipping traffic. (Cassar-FRC)
W81-01602

HYDROCARBONS IN VICTORIAN COASTAL WATERS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
K. A. Burns, and J. L. Smith.
Australian Journal of Marine and Freshwater Research, Vol 31, No 2, p 251-256, April, 1980. 1 Fig, 1 Tab, 13 Ref.

Descriptors: *Sea water, *Oil pollution, *Organic compounds, Analytical techniques, Municipal wastes, Industrial wastes, Mussels, Sediments, Oil spills, Coasts.

Sea water was analyzed for suspended and dissolved hydrocarbons to study the distribution of petroleum in Victorian coastal waters from chronic sources of oil pollution. A resin adsorption apparatus consisting of a glass fiber prefilter and a stainless column packed with Amberlite AXD-2 and teflon particles was used. Three areas of Victorian coastal waters were selected because of their importance in water quality management. Gas chromatographic and fluorescence patterns were used to distinguish between petroleum hydrocarbons and recent biogenic hydrocarbons. Levels of nonvolatile hydrocarbons in sea water ranged from less than 0.1 microgram/liter (the detection limit) to over 22 microgram/liter near shore-based inputs such as oil refinery effluents. Port Phillip Bay was exposed to higher oil loads than Western Port. Oil refinery effluent was the major input, but there were also various municipal and industrial effluents. Analyses of mussels and sediments confirmed the oil pollution problem in Port Phillip Bay area. Most Western Port areas were free of the effects of oil pollution, although there were intermittent fuel oil spills near wharves. (Small-FRC)
W81-01608

VERTICAL DISTRIBUTION OF METALS IN A SEDIMENT CORE OF A SUBALPINE LAKE INDICATING STAGES IN THE DEVELOPMENT OF CIVILIZATION. (VERTIKALE VERTEILUNG VON METALLEN IM SEDIMENT EINES ALPENVORLANDSEES ALS ZIVILISATIONSINDIKATOREN),
Munich Univ. (Germany, F.R.). Geographisches Inst.
G. Michler, K. Simon, F. Wilhelm, and C. Steinberg.
Archiv fur Hydrobiologie, Vol 88, No 1, p 24-44, February, 1980. 8 Fig, 2 Tab, 32 Ref. (English summary).

Descriptors: *Lake sediments, *Water pollution, Municipal wastes, Cores, Sampling, Metals, Varves, Water pollution, Runoff, Salts, Agricultural runoff, Lakes, Fertilizers, Coal mine wastes, *Bottom sediments, Age, Geologic history, *Bavaria.

A 382 cm sediment core taken from a subalpine lake in Upper Bavaria was examined for pigment content, loss on ignition and metal content (Na, K, Mg, Ca, Fe, Mn, Ni, Pb, Cd, Zn, Cu, and Cr). Loss on ignition and examination of varves showed a nearly constant rate of sedimentation over the past 1500 years, with an average yearly rate of 2.3-2.5 mm. Increased rates of sedimentation were found in the upper layers due to the development of eutrophic conditions in the lake. Anthropogenic influences were noted in the pattern of metal distributions. The increased Na and Cu levels at a depth of 170-180 cm were associated with deforestation during the 13th century, while increases in Mg reflected deforesting in the 14th century. Steady increases in Zn and Cd above 55 cm were connected with coal mining activities in nearby cities. The industrial expansion of the 20th century was observed in increased levels of Cr, Zn, Cd, and Pb, with accompanying greater motor traffic and municipal sewage pollution. High levels of Na and K in the uppermost layers were attributed to highway salting and the use of artificial fertilizers. (Geiger-FRC)
W81-01610

AN EVALUATION OF DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY AT A ROTATING GLASSY CARBON ELECTRODE FOR THE DETERMINATION OF CADMIUM, COPPER, LEAD AND ZINC IN ANTARCTIC SNOW SAMPLES,
British Antarctic Survey, London (England).
For primary bibliographic entry see Field 5A.
W81-01612

CHEMICAL SPECIATION OF MERCURY IN NATURAL WATERS,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W81-01614

THE EFFECT OF EMERSION ON CADMIUM ACCUMULATION BY MYTILUS EDULIS,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Labs.
For primary bibliographic entry see Field 5C.
W81-01648

POLYCHLORINATED BIPHENYLS IN THE BRISBANE RIVER ESTUARY, AUSTRALIA,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
G. R. Shaw, and D. W. Connell.
Marine Pollution Bulletin, Vol 11, No 12, p 356-358, December, 1980. 1 Tab, 12 Ref.

Descriptors: *Estuaries, *Water pollution sources, *Polychlorinated biphenyls, Aquatic animals, Food chains, Water birds, Food webs, Birds, Fish, Mollusks, Crabs, Arochlors, Sediments, Organic chemicals, Industrial wastes, Chemical wastes, Brisbane River(Australia), *Australia.

Concentrations of polchlorinated biphenyls (PCB) in water, sediments, fish, molluscs, polychaetes, and birds from the Brisbane River estuary were determined. Levels in samples from this industrial area of 900,000 population were similar to those in comparable urban locations. A table lists the species, sample type (for example, whole organism, lipid basis, etc.), and range of concentrations for Aroclor 1254 and 1260. In fish, the PCB concentration was higher in the gills than in muscle, on a lipid content basis. The chromatogram pattern implied that PCB's enter through the gill. Biomagnification of PCB in the food chain did not correlate with trophic class. The sea mullet, which has a low trophic class, showed high concentrations (maximum 2.9 mg per kg). However, the pelican, high on the food chain, exhibited the highest concentration (up to 15.7 mg per kg in muscle). (Cassar-FRC)
W81-01650

5C. Effects Of Pollution

INVESTIGATIONS OF WALKER LAKE, NEVADA: DYNAMIC ECOLOGICAL RELATIONSHIPS,
Nevada Univ. Systems, Reno. Desert Research Inst.
For primary bibliographic entry see Field 2H.
W81-01426

CORRELATION OF SEASONAL VARIATIONS IN PHOSPHOROUS AND NITROGEN SPECIES IN UPPER BLACK WARRIOR RIVER WITH DUCKWEED,
Alabama Univ., University. School of Mines and Energy Development.
F. C. Gabrielson, Jr., A. M. Malatino, and G. J. Santa Cruz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-160996, Price codes: A05 in paper copy, A01 in microfiche. Manuscript 6-77-01, October, 1980. 78 p, 1 Fig, 42 Tab, 21 Ref, 1 Append. OWRT A-052-ALA(1).

Descriptors: *Aquatic weeds, *Plant growth, *Growth rates, *Nutrient requirements, *Period of growth, Seasonal, Aquatic plants, Aquatic life, Freshwater plants, Aquatic vegetation, Aquatic weed control, Nutrients, Rivers, Essential nutrients, Chemical analysis, Nutrient removal, Water quality, Phosphorus, Nitrogen, Correlation analysis, Alabama, *Duckweed.

Water samples were taken for nitrogen and phosphorus from late 1975 through to the Spring of 1977 from nine stations. The drainage system had supported giant duckweed (Spirodela punctata) blooms. While seasonal separation of the data showed possible differences within an impoundment (Bayview Lake), extreme variations made meaningful conclusions difficult to obtain. Daily discharge from a large number of points may have masked seasonal differences. Extensive plant mats were present at minimal levels of nitrogen and phosphorus. The growth rate appeared to be governed more by climate than by nutrient conditions. Laboratory studies indicated that giant duckweed can grow under a wide range of nutrient conditions, including heavy metal concentrations. Growth rate data demonstrated that, without a continual input of nutrients, maximum growth rates do not typically continue beyond 14-20 days, regardless of the initial single element concentration. However, using a continuous nutrient input, growth would probably be inhibited only by extreme climate conditions. (Zielinski-IPA)
W81-01428

LAKE ERIE NUTRIENT CONTROL: EFFECTIVENESS REGARDING ASSESSMENT IN EASTERN BASIN.
State Univ. of New York Coll. at Buffalo. Great Lakes Lab.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-225097, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-067, July, 1980. 100 p, 26 Fig, 18 Tab, 30 Ref. R802706.

Descriptors: *Lake Erie, *Limnology, *Eutrophication, *Biota, Great Lakes, Water pollution, Invertebrates, Phytoplankton, Zooplankton, Benthos, Oxygen demand, *Nutrients, Aquatic environment, Water temperature, Biomass, Phosphorus, Nitrogen, Mesotrophy, Aquatic populations.

A three year synoptic monitoring program was conducted on 26 stations in the Eastern Basin of Lake Erie from 1973 to 1975. The data generated include major nutrients, temperature structure, and oxygen depletion as well as phytoplankton, zooplankton and benthic macroinvertebrate dynamics. The Eastern Basin surface waters were differentiated into five discrete areas with each water mass characterized by a different physiochemical variable. These areas appeared to be highly influenced by local inputs from specific tributaries and population centers. Anoxic conditions were not observed in the hypolimnetic waters of the Eastern Basin over the study duration and the oxygen demand was calculated to be approximately 0.011 g oxygen/cubic meter/day. The Eastern Basin has remained relatively stable over the past five years with the exception of a decrease in phytoplankton biomass, increase in nitrogen, and a doubling of benthic macroinvertebrates. Several organisms, especially the oligochaetes, associated with more eutrophic values of the Western and Central Basin have become established in large numbers within the Eastern Basin. From a trophic standpoint, the basin can be classified as mesotropic. Reductions in algal growth may be in response to pollution abatement, particularly phosphorus. (Moore-SRC)
W81-01438

EFFECT OF CARBON, AMMONIA NITROGEN AND HYDRAULIC LOADING RATES, RPM, AND EXPOSED SURFACE AREA VARIATIONS ON RBC PERFORMANCE,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W81-01476

MICROFAUNA AND RBC PERFORMANCE: LABORATORY AND FULL SCALE SYSTEMS,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W81-01477

CHEMICAL CONTAMINANTS AND BIOLOGICAL ABNORMALITIES IN CENTRAL AND SOUTHERN PUGET SOUND,
National Marine Fisheries Service, Seattle. Northwest and Alaska Fisheries Service.
D. C. Malins, B. B. McCain, D. W. Brown, A. K. Sparks, and H. O. Hodgins.
NOAA Technical Memoorandum OMPA-2, November, 1980. 311 p, 78 Fig, 38 Tab, 127 Ref, 9 Append.

Descriptors: *Estuarine environment, *Washington, *Water pollution, *Sediments, *Aquatic animals, *Animal pathology, Chlorinated hydrocarbon pesticides, Water pollution effects, Invertebrates, Fish, Arsenic, Lead, Organic compounds, Polychlorinated biphenyls, Metals, Oil pollution, Benthic fauna, Crabs, Shrimp, Clams, Worms, Puget Sound(WA).

Samples of sediments and bottom-dwelling fishes, crabs, shrimps, clams, and worms were collected at quarterly intervals in 1979 from four urban embayments in Puget Sound: Elliott Bay (Seattle), Commencement Bay (Tacoma), Sinclair Inlet (Bremerton), and Budd Inlet (Olympia). Similar sampling was done in two nonurban areas: Case Inlet and Port Madison. Sediment samples were analyzed for petroleum hydrocarbons, polychlorinated biphenyls, chlorinated pesticides and other chlorinated organic compounds, and metals. The community characteristics of the sediment-associated invertebrates and bottom fish were defined; and their tissues were analyzed for the above-mentioned organic compounds and metals. The highest concentrations of the organic compounds and some metals, such as arsenic and lead, in sediments were in samples from the waterways of Commencement Bay; the Duwamish Waterway, Seattle Watefront, and West Point areas of Elliott Bay; and from Point Herron in Sinclair Inlet. Highest concentrations of many of the chlorinated organic compounds, including hexachlorobutadiene, were in sediment samples from Commencement Bay and its adjacent waterways. Tissue samples generally had concentrations of organic contaminants which reflected the chemical composition of sediment in the subarea from which the organisms were obtained. Petroleum hydrocarbons, polychlorinated biphenyls, chlorinated pesticides, hexachlorobenzene, and hexachlorobutadiene were detected in various concentrations in several types of organisms from both urban and nonurban sites. In most cases animals were also examined for grossly visible and microscopic lesions. Several types of liver lesions were found more frequently in fish from sampling areas with the sediments most highly contaminated by toxic chemicals. Abnormalities were also found in shrimp and crab species in the most polluted areas. (Moore-SRC)
W81-01479

EFFECTS OF THERMAL POLLUTION ON PELAGIC LARVAE OF CRUSTACEA,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
A. N. Sastry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-222037, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-064, July, 1980. 65 p, 25 Fig, 13 Tab, 68 Ref. R-800981.

Descriptors: *Thermal pollution, *Crustaceans, *Larvae, *Estuarine environment, *Salinity, Invertebrates, Water pollution, Growth stages, Coasts, Physiological ecology, Animal physiology, Environmental effects, Cycles, Animal metabolism, Commercial shellfish, Lobsters, Crabs, Shrimp, Water temperature.

Thermal alterations of the coastal and estuarine environments from conventional and nuclear power plants may have considerable effects on the biotic communities. To develop the capability for assessment of the effects of thermal alterations, there is a need for a comprehensive understanding of the effects of thermal changes on all the life stages of populations within the communities. Larvae of six species were studied: Cancer irroratus, C. borealis and Homarus americanus of coastal waters; and Palaemonetes pugio, Pagurus longicarpus and Rhithropanopeus harrisii, from the estuarine region. Larvae were cultured at various combinations of temperature and salinity, and highest survival rates and limits for complete development determined. Generally, coastal species had a more restrictive temperature range for complete development than estuarine species. Survival was betteer for C. irroratus larvae cultured under certain daily cyclic regimes versus a constant temperature. The larvae of coastal species C. irroratus and H. americanus were metabolically active over a narrower temperature range compared to the primar-

ily estuarine species Palaemonetes pugio. Metabolic - temperature response patterns of the larval stages of each species cultured at daily cyclic temperatures were altered relative to those cultured at comparable constant temperatures. When temperature and low dissolved oxygen stresses were combined, the thermal tolerance limits of C. irroratus larval stages were altered. (Moore-SRC)
W81-01482

CHARACTERISTICS OF BENTHIC ALGAL COMMUNITIES IN THE UPPER GREAT LAKES,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
E. F. Stoermer.
Environmental Protection Agency Report EPA-600/3-80-073, July, 1980. 79 p, 1 Tab, 16 Ref, Append. 803037.

Descriptors: *Great Lakes, *Benthic flora, *Eutrophication, *Aquatic algae, Water pollution, Water quality, Algae, Benthos, Diatoms, Limnology, Oligotrophy, Distribution.

The upper Great Lakes contain a diverse array of benthic algal communities. Diatoms are the dominant taxonomic group present in terms of numbers, and usually in terms of biomass, except in eutrophic areas. Communities in areas receiving minimal direct anthropogenic impact are extremely diverse in terms of both species richness and population evenness. A significant number of populations found in undisturbed habitats in the upper Great Lakes have not been previously reported from North America. Benthic communities in more eutrophic areas are characterized by a greater abundance of eurytopic and widely distributed taxa. Many of these species are familiar elements of the floras of smaller, mesotrophic to eutrophic lakes. The communities of directly impacted areas contain a more limited suite of very tolerant populations, usually occurring in high abundance. Species usually reported from saline inland waters or brackish water are a conspicuous element of the flora in highly disturbed regions. The available evidence indicates that the range of many oligotrophic species which originally occupied the entire upper Great Lakes has been severely restricted. Such populations are apparently adversely affected by very low levels of contamination, which suggests that they may be useful in early detection of adverse trends in the system. The recent introduction of a number of species not characteristic of oligotrophic systems, or indeed even of freshwater lakes, indicates continuing degradation of the upper Great Lakes. (Moore-SRC)
W81-01487

ENVIRONMENTAL EFFECTS OF WESTERN COAL SURFACE MINING, PART VIII-FISH DISTRIBUTION IN TROUT CREEK, COLORADO, 1975-1976,
Colorado Div. of Wildlife, Fort Collins. Fisheries Research Center.
J. P. Goettl, Jr., and J. W. Edde.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-224736, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-070, July, 1980. 36 p, 3 Fig, 7 Tab, 19 Ref. R803950.

Descriptors: *Mine drainage, *Coal mines, *Fish, *Mine water, Water pollution, Colorado, Brook trout, Rainbow trout, Brown trout, Sculpins, Dace, Fish management, Distribution, Toxicity, Fish stocking, *Environmental effects, *Trout Creek(CO).

A study was conducted on Trout Creek in northwestern Colorado during 1975-1976 to assess the effects of drainage from an adjacent surface coal mine on the distribution of fishes in the creek, and to relate their distribution to physical and chemical variables. A second objective was to determine the possible toxicity off surface coal mine drainage water on fish stocked in ponds receiving surface and groundwater run-off from the mine. Results did not indicate any direct effects of mine drainage water on the distribution of fishes in Trout Creek, although possible effects may have been masked by elevation, stream flow, streambed alterations, and agricultural irrigation return flows. Brook trout (Salvelinus fontinalis) was the dominant salmonid species in the upper reaches of the creek; rainbow trout (Salmo gairdneri) and brown trout (S. trutta) were found only in the region of the mine. Mottled sculpin (Cottus bairdi) and speckled dace (Rhinichtys osculus) were the most common fishes found throughout and at all but the uppermost reaches, respectively. Rainbow trout stocked in mine seepage water ponds for a year evidenced high survival rates over an eight-month period during the winter, but fared poorly during the ensuing summer months, this latter most probably because of extremely high water temperatures. There was no apparent evidence of toxicity to the fish from contaminants in the mine pond water. (Author's abstract)
W81-01488

EFFECTS OF WATER QUALITY ON FISH,
Purdue Univ., Lafayette, IN. Dept. of Forestry and Natural Resources.
A. Spacie.
Purdue University Cooperative Extension Service, 208 Planning Notes, prepared by the Indiana Inter-Agency Information and Education Committee on Non-Point Source Pollution, Planning Note No 9, (1980). 4 p, 1 Fig, 1 Tab.

Descriptors: *Water quality, *Fishkill, *Pollutants, Oxygen, Pesticides, Ammonia, Siltation, Water pollution effects, Fish, *Indiana, Federal Water Pollution Control Act.

This is one of a series of fact-sheets being developed concerning the Federal 'Clean Water Act' (Public Law 92-500) and water quality management planning efforts underway in Indiana, as prescribed by Section 208 of the Law. Major emphasis in the fact sheets is on non-point sources of pollution, their effects on water quality, possibilities for control and the implications of various control strategies, the purpose of this series is to provide an 'information base' for meaningful citizen input into the water quality management planning process at the local level. This fact sheet answers such questions as Who's to blame for fish kills. What are the effects of pollutants. What are the major causes of fish kill, and Will water quality management make a difference.
W81-01504

MICRO-ORGANIC COMPOUNDS IN THE WATER ENVIRONMENT AND THEIR IMPACT ON THE QUALITY OF POTABLE WATER SUPPLIES,
Water Research Commission, Pretoria(South Africa).
G. J. Stander.
Water SA, Vol 6, No 1, p 1-14, January, 1980. 6 Fig, 19 Tab, 25 Ref.

Descriptors: *Organic compounds, *Potable water, *Public health, Pollutant identification, Water quality, Odor, Taste, *Water pollution effects, Reviews, Chlorination, Water purification, *Water treatment, Pollutants.

Sources of organics in natural waters are decay of animal and plant life, biological activities, industrial wastes, domestic wastes, and non-point sources such as agricultural chemicals and combustion products. Although up to 360 organic compounds have been identified in drinking water in a number of countries, only about 50 occurred at concentrations above 1 microgram per liter. Since analysis of water for micro-organics is very costly, it is suggested that bioassay screening tests be performed on water supplies most likely to be polluted with organic chemicals. If these tests have positive results, further identification and toxicologic studies should be performed. Chlorination may intensify odor and taste problems by forming undesirable halogenated hydrocarbons. Treatment plants which remove trace organic compounds completely are beyond practical considerations. Therefore, it is better to clean up industrial and sewage effluents before they reach the water purification process. (Cassar-FRC)
W81-01505

CANCER MORTALITY AND PUBLIC DRINKING WATER IN ST. LOUIS CITY AND COUNTY,
Missouri Univ.- Columbia.
For primary bibliographic entry see Field 5F.
W81-01534

ELEVATED LEVELS OF SODIUM IN COMMUNITY DRINKING WATER,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 5F.
W81-01535

NUTRIENT RUN-OFF FROM THE CATCHMENT AREA TO A SMALL LAKE WITH NO EFFLUENT,
Instytut Gleboznawstwa i Chemii Rolnej, Lublin (Poland).
M. Misztal.
Acta Hydrobiologica, Vol 22, No 1, p 55-66, 1980. 3 Fig, 3 Tab, 13 Ref.

Descriptors: *Nutrients, *Agricultural runoff, *Lake sediments, Water chemistry, Watersheds(Basins), *Lakes, Soil chemistry, Phosphorus, Calcium, Sodium, Potassium, Precipitation(Atmospheric), *Poland, Inflow.

The effects of agricultural runoff and woodland runoff on the chemical composition of shallow sediments in Lake Piaseczno (Leczynsko-Wlodawshie Lake District, Poland) were examined. The catchment area is made up of 48 ha of woods, 85 ha of water, and 131 ha of agricultural lands. Soils in the catchment area and lake sediments were sampled and analyzed for chemical content. K(+), Na(+), Ca(++) were determined by the photmetric method, while P was determined with ammonium molybdate, and Mg(++) was determined with titanium yellow. Rainfall during the sampling period (1973-1976) was also measured. Correlation coefficients indicated a close relationship between water soluble forms of potassium salt, manganese, and sodium found in both the soil and the sediments. No correlation was found between their contents of phosphorus compounds. The effects of rainfall were noted. High water levels in the lake tended to counteract penetration of enriched groundwaters into its basin. Drought was not conducive to the accumulation of phosphorus compounds, while during a wet year (1974), water soluble forms of phosphorus increased in the lake Lake water pH was highest during times of increased rainfall. (Small-FRC)
W81-01553

TOWARDS A NITRATE BALANCE FOR ENGLAND AND WALES,
Department of the Environment, Reading (England). Water Data Unit.
For primary bibliographic entry see Field 5B.
W81-01561

IDENTIFICATION OF A DYNAMIC LAKE MODEL BY THE GROUP METHOD OF DATA HANDLING: AN APPLICATION TO LAKE ONTARIO,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W81-01578

SIMULATION OF SOIL NUTRIENTS LOSSES RESULTING FROM RAINFALL ACIDITY,
Colorado State Univ., Fort Collins.
J. O. Reuss.
Ecological Modelling, Vol 11, No 1, p 15-38, October, 1980.

Descriptors: *Mathematical models, *Acidic water, *Leaching, Soil properties, Precipitation(Atmospheric), Nutrients, *Soil chemistry, Ion exchange, Ions, Chemical reactions, *Acid rain, Adsorption.

A simulation model is described which provides a quantitative system using basic soil chemistry to predict the most likely effect of rainfall acidity on the leaching of cations from noncalcareous soils. The model uses the relationships between lime potential and base saturation (Clark and Hill, 1964, and Turner and Clark, 1964), the equilibrium between CO2 partial pressure and H+ and HCO3- in solution, the apparent solubility product of Al(OH)3, the equilibrium of cations and anions in solution, the Langmuir isotherm description of sulfate adsorption, and mass balance considerations. It predicts the distribution of ions between the solution and sorbed or exchangeable phases. Thus, ionic composition of leachate can be computed. The initial model results indicate that base removal due to rainfall acidity from actual soil systems can be investigated experimentally by increasing the acidity of applied water to levels in excess of that normally found in rain. This shortens the necessary experimental time. (Small-FRC)
W81-01579

CORRELATION BETWEEN UREA AND OTHER CHEMICAL AND BIOLOGICAL PARAMETERS IN WATERS OF LAKE SUWA, JAPAN,
Yamagata Univ. (Japan). Dept. of Chemistry.
Y. Satoh, T. Okino, and K. Aoyama.
Internationale Revue der Gesamten Hydrobiologie, Vol 65, No 3, p 445-454, 1980. 3 Fig, 1 Tab, 29 Ref.

Descriptors: *Ureas, *Eutrophication, *Decomposing organic matter, Nutrients, *Lakes, Nitrogen, Phytoplankton, Photosynthesis, *Japan, Lake Suwa(Japan).

The vertical profiles of chemical and biological treatment parameters, including urea concentration, were measured periodically since 1977 in Lake Suwa, Japan, a typical eutrophic lake. The standing stock of urea in a central water column of the lake showed two major peaks around May 1977 and May 1978, and three minor peaks around early August, late September, and mid-November 1977. These peaks may be due at least in part to urea production by bacterial decomposition of dead phytoplankton. The ratio between standing stock of urea and that of total inorganic nitrogen in the eutrophic zone increased significantly from mid-July to early October in 1977. This ratio was significantly lower the rest of the year; however, the standing stock of urea was relatively high. On the basis of Kendall's rank correlation coefficient, urea has been suggested to act as a nutrient during the process of photosynthesis on 7 days out of 33 observed. Also, the tau coefficients of urea to ammonia, nitrite, total carbonate carbon, gross production, net production, dissolved oxygen, and pH demonstrated a correlation significant enough to support the assumption that urea acted as a nutrient in the course of photosynthesis by phytoplankton. Thus, the vertical distribution of urea may be regulated by the photosynthetic activities of phytoplankton on certain occasions. (Small-FRC)
W81-01592

CHEMICAL AND MINERALOGICAL COMPOSITION OF THE MUD-WATER INTERFACE OF THE LAKE HULEH (ISRAEL) PRESERVE,
Pittsburgh Univ., PA. Dept. of Biological Sciences.
U. M. Cowgill.
Internationale Revue der Gesamten Hydrobiologie, Vol 65, No 3, p 379-409, 1980. 25 Fig, 43 Ref.

Descriptors: *Mud-water interfaces, *Lake sediments, *Chemical reactions, On-site investigations, Sediments, Ponds, Rivers, Sediment transport, Sorption, *Israel, Metals, Elements(Chemical), Mineralogy.

The chemical composition of the mud-water interface of a shallow pond with an inlet and an outlet was determined. Elements found in the mud-water interface of Lake Huleh Preserve (Israel) to a greater extent than in the surface waters were: Na, K, Ca, Ag, Cu, Mg, Sr, Ba, Zn, B, Ga, Se, Y, La, Ce, Si, Ge, Pb, Hf, P, As, Nb, S, Se, Cr, F, Mn, Co, and Ni. Some elements, including Br and Cd, are sorbed and retained by organic matter. Others behave as a sort of colloidal soup; elements (Cs, Be, Hg, Sn, Ti, Zr, Bi, V, Mo, I, and Fe) are sorbed by the scavenger action of ferric hydroxide type complexes. A chemical comparison of the composition of the Jordan River before and after it leaves the preserve gives some indication of the contributions of the river. Elements that showed a positive effect were: Na, Rb, Cu, Mg, Ca, Ba, Zn, Cd, Al, Ga, Y, La, Ce, Si, Ge, Sn, Pb, and others. The drainage of carp ponds into the preserve has a chemical effect on the Jordan River. (Small-FRC)
W81-01595

ACIDIFICATION OF A SMALL WATERSHED IN SOUTHERN NORWAY AND SOME CHARACTERISTICS OF ACIDIC AQUATIC ENVIRONMENTS,
Oslo Univ. (Norway). Zoological Inst.
J. P. Nilssen.
Internationale Revue der Gesamten Hydrobiologie, Vol 65, No 2, p 177-207, 1980. 11 Fig, 6 Tab, 109 Ref.

Descriptors: *Air pollution, *Acidity, *Lakes, Fish, Aquatic life, Small watersheds, Precipitation(Atmospheric), Invertebrates, Plankton, Hydrogen ion concentration, *Norway, *Acid rain.

Freshwater lakes in a region of southern Norway which receives a substantial amount of atmospheric pollutants were studied for acidity and biolgical characteristics. Precipitation in the area has a pH of 4.2-4.5. The acid originates further south in Europe, but prevailing winds bring this pollution to Norway. In some lakes which have lost buffering capacity, spring thaw and autumn rain are accompanied by increases in conductivity and in sulfate deposition, and by a conspicuous drop in pH. Decreasing pH, increasing conductivity, and increasing total hardness have been observed in a river draining the area. Fish, daphnia, and chaoborus have disappeared from the most acidic lakes, and these lakes are characterized by increasing abundance of Juncus bulbosus and macrophytes covered by filamentous algae. Pelagic zooplankton are mainly of the littoral species, and there are no leeches or gastropods. Brown trout is the fish most resistant to acid, while Eurasian perch were absent from most of the acid lakes. Moderately acidic lakes contained abundant food for carnivorous fish. (Small-FRC)
W81-01596

ON THE MECHANISM REDUCING THE PHOSPHATE CONCENTRATION IN THE WATER OF LAKE BALATON,
Research Inst. for Water Resources Development, Budapest (Hungary). Inst. for Water Quality Control.
E. Dobolyi, and S. Herodek.
Internationale Revue der Gesamten Hydrobiologie, Vol 65, No 3, p 339-343, 1980. 3 Fig, 3 Ref.

Descriptors: *Phosphorus compounds, *Nutrient removal, *Organic matter, *Hungary, Eutrophication, Algae, Lake Balaton(Hungary), Phosphates, Water pollution, Lake sediments, Aquatic algae, Plankton, Lakes, Bacteria, Aquatic life.

The main process responsible for phosphate reduction in Lake Balaton, Hungary, was direct uptake by algae. Although this lake's phosphate load grows continually, the dissolved orthophosphate has remained at a low level, 1 to 14 micrograms per liter. When phosphate was added to lake water in situ and in vitro, it was quickly removed. However, addition of sodium hypochlorite to kill algae and bacteria caused the phosphate level to remain constant, showing that biolgical activity was responsible for phosphate removal. When a complexing agent was added to prevent formation of biogenic lime, it did not influence rapid phosphate removal. A photooxidation experiment also showed that phosphate was incorporated into organic particulate matter. (Cassar-FRC)
W81-01597

A LIMNOLOGICAL RECONNAISSANCE OF THE LOUGH ERNE SYSTEM, IRELAND,
Ministry of Agriculture, Antrim (Northern Ireland). Freshwater Biological Investigation Unit.
For primary bibliographic entry see Field 2H.
W81-01598

COMBINED EFFECT OF THE CHLORIDES OF MERCURY AND COPPER IN SEA WATER ON THE EURYHALINE AMPHIPOD GAMMARUS DUEBENI,
Southhampton Univ. (England). Dept. of Oceanography.
S. M. Moulder.
Marine Biology, Vol 59, No 4, p 193-200, 1980. 5 Fig, 2 Tab, 19 Ref.

Descriptors: *Mercury, *Copper, *Amphipoda, *Water pollution effects, Metals, Sea water, Aquatic animals, Crustaceans, Invertebrates, Toxicity, Absorption, Water quality standards, Interactions.

A sublethal level of copper reduced the toxicity of inorganic mercury in Gammarus duebeni, a euryhaline amphipod. The metals, used as chlorides, were tested using 3 independent methods: 96 hours LC50, diuresis, and degree of Hg accumulation. LC50 values were as follows: Cu only, greater than 10,000; Hg only, 122; Hg preceded by pretreatment with a sublethal dose of Cu, 165; Hg plus Cu, 1520. Likewise, Cr51-EDTA clearance tests showed that Cu and Hg together (t1/2 value 81.3 hours) had less influence on diuresis than their additive effects (81.9 and 67.9 hours, respectively). Cu and Hg together produced less Hg accumulation in Gammarus than a program of Cu pretreatment followed by Hg exposure. This was also true in organic-free media. Hg accumulation concentration factors after 25 hours were Hg alone, 340; Hg plus Cu, 62; and Hg with Cu pretreatment, about 50. The possible mechanisms of interaction between Hg and Cu, including binding on SH sites and detoxification, were discussed. (Cassar-FRC)
W81-01599

FISH POPULATION DYNAMICS UNDER NUTRIENT ENRICHMENT - A CASE OF THE EAST SETO INLAND SEA,
Kyoto Univ. (Japan). Dept. of Applied Mathematics and Physics.
S. Ikeda, and T. Yokoi.
Ecological Modelling, Vol 10, No 3/4, p 141-165, August, 1980. 16 Fig, 7 Tab, 11 Ref.

Descriptors: *Mathematical models, Fish, *Predation, Plankton, *Fish populations, Eutrophication, Nutrients, Nitrogen, Phosphorus, Environmental effects, Mortality, *Seto Inland Sea(Japan), Japan.

A theoretical model of fish population dynamics in a primarily nitrogen and phosphorus enriched eutrophic inland sea is presented. A significant increase in pollutants in the sea and the slow exchange rate of sea water between the sea and the ocean have worsened the general condition of the East Seto Inland sea in recent years. The proposed model is based on the prey-predator relationship of the Lotka-Volterra type. The model was validated by checking recent fishery statistics of the area. The three population variables are: plankton, small fish, and large fish. Assessment of the effect of external pollution loading was essential for the identification of fish population dynamics in the sea. The simulation shows that the assumptions on fish mortality and carrying capacity of plankton in the nutrient-enriched sea could partially explain trends in recent fish catches. (Small-FRC)
W81-01603

THE TURNOVER RATE OF DISSOLVED ORGANIC MATERIAL IN WATERS USED BY ANADROMOUS PACIFIC SALMON ON THEIR RETURN TO GREAT CENTRAL LAKE ON VANCOUVER ISLAND, BRITISH COLUMBIA, CANADA,
Tsukuba Univ., Ibaraki (Japan). Inst. of Biological Sciences.
H. Seki, E. A. MacIsaac, and J. G. Stockner.
Archiv fur Hydrobiologie, Vol 88, No 1, p 58-72, February, 1980. 3 Fig, 4 Tab, 26 Ref.

Descriptors: *Oligotrophy, *Fish migration, *Salmon, *Aquatic ecosystems, Nitrogen, Phos-

phorus, Nutrients, *Organic matter, Carbohydrates, *Lakes, Microbial degradation, Fertilizers, Spawning, Sockeye slamon, Phytoplankton, Aquatic productivity, Water quality, Pulp wastes, Surface waters, *Great Central Lake(Canada), Vancouver Island(BC), British Columbia.

When salmon return to freshwaters to spawn, it is theorized that an olfactory imprinting device allows them to locate their parent stream. The turnover rate of dissolved organic materials by microbial activity is considered an important factor in the chemistry of this aquatic spawning system. In the present study, the uptake kinetics of a variety of organic substrates in the surface layer of aquatic systems through which adult salmon pass on their return to Great Central Lake inlet were examined. Particulate organic carbon levels were highest in surface waters of Trevor Channel and central Alberni Inlet. This was attributed in part to the organic matter discharged by the pulp mill at the head of the inlet. The microbial differences of fertilized and unfertilized areas of this Canadian lake were also studied, and the increases in primary production in response to phosphorus and nitrogen additions were investigated. Turnover times were a few weeks at the entrance to Alberni Inlet, a few days in central Alberni Inlet, a few weeks in the Stamp River, a few weeks for amino acids and galactose, and less than several days for organic acids and glucose in Great Central Lake. Fertilized regions produced higher microbial biomass, a concept which is discussed in terms of increased organic excretions from the growth-stress oscillating phytoplankton population. Heterotrophic uptakes and primary production indicate that the Great Central Lake is within the steady-state equilibrium of a temperate oligotrophic lake. (Geiger-FRC)
W81-01607

AMMONIA MINERALIZATION AND CYCLING IN SHAGAWA LAKE, MINNESOTA,
Oklahoma State Univ., Stillwater. School of Biological Sciences.
For primary bibliographic entry see Field 2H.
W81-01609

THE EFFECT OF EMERSION ON CADMIUM ACCUMULATION BY MYTILUS EDULIS,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Labs.
N. Coleman.
Marine Pollution Bulletin, Vol 11, No 12, p 359-362, December, 1980. 2 Tab, 25 Ref.

Descriptors: *Cadmium, *Mussels, *Water pollution effects, Metals, Aquatic animals, Shellfish, Path of pollutants, Victoria(Australia), *Australia, Mytilus edulis, Submergence, Littoral.

Mussels were immersed for 15 days in sea water and in sea water containg 0.35 ppm or 0.035 ppm cadmium either continuously or alternately submerged and drained. Results, expressed in ppm Cd per dry weight, were as follows: sea water drained, 1.13 + or - 0.42; sea water undrained, 1.57 + or - 2.17; 0.035 ppm Cd drained, 24.1 + or - 6.61; 0.035 ppm Cd undrained, 38.96 + or - 27.03; 0.35 ppm Cd drained, 155.5 + or - 55.06; 0.35 ppm Cd undrained, 277.55 + or - 93.28. Lowest Cd concentrations were found in drained mussels in sea water; highest in mussels in undrained water containing 0.35 ppm Cd. Although drained mussels were submerged for only half as long as undrained mussels, they accumulated more than half as much Cd. This may have been the result of increased activity upon reimmersion. After only 15 days, mussels exposed to 0.035 ppm Cd, permissible under current legislation in Victoria, accumulated more than the 2.0 ppm net weight limit specified for human consumption. (Cassar-FRC)
W81-01648

TISSUE DISTRIBUTION OF MERCURY IN NORMAL AND ABNORMAL YOUNG COMMON TERNS,
Rutgers Medical School, Piscataway, NJ. Div. of Occupational and Community Medicine.
M. Gochfeld.
Marine Pollution Bulletin, Vol 11, No 12, p 362-366, December, 1980. 3 Tab, 27 Ref.

Descriptors: *Mercury, *Birds, *Terns, *Water pollution effects, Water pollution sources, Water birds, Liver, Food chains, *Long Island(NY), New York, Path of Pollutants, Pollutant identification.

The large right lobe of the liver was the single tissue which provided the best estimate of mercury levels in other tissues, according to Hg tissue distribution studies done on 16 young Common Terns from colonies on the south shore of Long Island, New York. Whole blood and kidney had mean correlation coefficients of 0.38 and 0.36 respectively, near that of liver, 0.40. Muscle, brain, and feather showed little correlation, 0.18, 0.02, and 0.22. Levels were highest in blood and lowest in brain. Four birds which showed feather loss had about twice the mercury level in all tissues compared to the 12 normal birds. Levels of Hg in chicks 10-30 days old were slightly, but insignificantly, higher than compared with chicks 1-9 days old. (Cassar-FRC)
W81-01649

5D. Waste Treatment Processes

STATE OF WASHINGTON INDUSTRIAL WASTE SURVEY.
URS Co., Seattle, WA.
Report prepared for Washington State Department of Ecology, 1980. 45 p, 3 Fig, 7 Tab, 3 Append, 14 Maps.

Descriptors: *Washington, *Surveys, *Industrial wastes, *Waste water treatment, *Municipal water, Pollutants, Pre-treatment(Water), Cities, Sewage treatment, Chemical analysis, Pollutants, Organic compounds, Toxicity, Waste dilution, Measurement, Pulp and paper industry.

Many communities treat both industrial and residential waste waters at the municipal waste water treatment plant. The EPA-promulgated Pretreatment Regulation governs the control of industrial wastes into Publicly Owned Treatment Works (POTWs). Washington State needed definitive data to determine which POTWs would require local pretreatment programs. An industrial waste survey was conducted of commercial and industrial users that discharge, or potentially discharge, liquid and solid wastes to the sewer systems of 14 municipalities. Twenty-one industrial categories were included, as were businesses discharging excess pollutants. The survey, directed toward 129 species of chemical compounds representing 65 priority pollutant groups, was in two phases: inventory development, and questionnaire review and follow-up. Industries were initially identified by SIC code to determine suitability. Questions were asked to determine type of waste produced, general waste water characteristics of the facility, and the use and disposal of priority pollutants, Statewide, the major priority pollutant compounds identified included the heavy metals, aromatic and chlorinated hydrocarbons, phenolic compounds and cyanide. The major source of priority pollutants appeared to be paper products firms and inorganic chemical manufacturers. Breweries, photofinishers and hospitals may also produce and/or discharge priority pollutants. Each municipal sewer ordinance was evaluated using EPA's Model Ordinance covering industrial waste dischargers; however, none covered all of EPA's provisions. (Atkins-Omniplan)
W81-01434

FINE SOLIDS REMOVAL FOLLOWING COMBINED CHEMICAL-TRICKLING FILTER TREATMENT,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. C. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-140659, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-099, July, 1980. 36 p, 7 Fig, 7 Tab, 1 Ref. 68-03-0225.

Descriptors: *Waste water treatment, *Settling basins, *Filtration, *Suspended solids, Water purification, Chemical precipitation, Sewage treatment, Flocculation, Trickling filters, Treatment, Sludge.

Significant carryover of fine alum floc solids was observed in final effluent during earlier plant-scale studies of alum addition to the final clarifier of a high-rate trickling filter train of a waste water treatment plant. The effectiveness of fine solids settling ponds, and various types of granular media filters for removing residual fine solids from the effluent of a conventional, high-rate, rock media trickling filter plant when alum is applied ahead of secondary clarification is evaluated. Two pilot settling ponds, one covered and one open, were operated at detention times ranging from 8 to 30 hours. Two pilot granular media filters were operated at filtration rates ranging from 1.0 to 2.0 l/sec/square meter. The filters were operated in both downflow and upflow modes, with various media used in each operational mode. The pilot settling ponds did not perform as expected. Anaerobic conditions, which developed in the settled sludge, disrupted the floc structure and resuspended previously settled solids. Very modest improvement in final effluent quality, generally less than 25%, was observed. The two filters when operating in a downflow mode with two different configurations of anthracite and sand media, proved about equal in performance, achieving 65-86% incremental removals of suspended solids. Upflow filter operation produced a slightly lower effluent quality, but resulted in lower rates of headloss buildup and substantially longer filter runs. (Moore-SRC)
W81-01436

JET AERATION CHANNEL SYSTEM,
Houdaille Industries, Inc., Fort Lauderdale, FL.(Assignee).
M. G. Mandt.
U.S. Patent No 4,199,452, 14 p, 7 Fig, 1 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 933, No 4, p 1372-1373, April 22, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Sewage treatment, Activated sludge, Oxidation, Flow control, Aerobic treatment.

This invention is directed to aerobic waste water treatment systems having improved energy requirements, which can be adapted to efficiently compensate for diurnal or other variations in sewage flow that are commonly found in medium size sewerage treatment plants. The system comprises an oxidation ditch for confining and retaining the waste liquid and defining a continuous closed flow path through which the confined liquid is moved, a first raw waste pump activated by an intermediate level of raw waste received, a second raw waste pump activated by a high level of raw waste, a first blower activated during operation of either first or second raw waste pumps, gas-liquid contactors for receiving raw waste from either or both raw waste pumps and air from the first blower and for discharging a high velocity raw waste liquid-air jet or mixed liquor into the oxidation ditch below the surface. (Sinha-OEIS)
W81-01443

SPLIT FLOW WATER TREATMENT PLANT,
Neptune Microfloc, Inc., Corvallis, OR. (Assignee).
For primary bibliographic entry see Field 5F.
W81-01445

PROCESS FOR SEPARATING AQUEOUS MINERAL ACID MIXTURES,
Monsanto Co., St. Louis, MO. (Assignee).
R. Chiang, and E. Perry.
U.S. Patent No 4,199,445, 8 p, 5 Ref; Official Gazette of the United States Patent Office, Vol 993, No 4, p 1370-1371, April 22, 1980.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, Acids, Membrane processes, Water vapor, Product concentration.

The separation of components, one of which is water, such as formaldehyde and water, in order to

obtain a more highly concentration solution by removing at least a portion of the water from the feed solution is described. The process comprises contacting the feed mixture against one side of an ionic organic membrane, composed of organic polymers having active anionic groups derived from acids, and withdrawing at the second side a mixture having higher concentration of water. It is also essential that the mixture at the second side be maintained at a lower chemical potential than the feed side. It is also essential that the product be withdrawn at the second side in the vapor state. Multistate operation may also be feasible since this permits the operation of individual stages at various concentrations and temperatures in order to achieve the optimum driving forces for the process. (Sinha-OEIS)
W81-01448

PROCESS FOR DECOLORIZING PULP AND PAPER MILL WASTE WATER,
Sybron Corp., Rochester, NY. (Assignee).
J. E. Blair, and L. T. Davis.
U. S. Patent No 4,199,444, 6 p, 9 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 993,, No 4, p 1370, April 22, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, *Pulp and paper industry, Bleaching wastes, Color, Aerobic conditions, Microorganisms, Pseudomonas aeruginosa.

The object of this invention is to provide a biological process for the treatment of pulp and paper mill waste water effluent to not only remove biodegradable organic matter, but to specifically reduce or decolorize the waste water. The biological treating process uses a mutant strain of Pseudomonas aeruginosa. The mutant microorganism does not require the addition of carbohydrates to the system and is well adapted to biological treatment systems. (Sinha-OEIS)
W81-01449

INSTALLATION FOR TREATMENT OF SEDIMENTS COMING FROM STATIONS FOR PURIFICATION OF INDUSTRIAL WASTE WATER,
Regie Nationale des Usines Renault, Boulogne-Billancourt (France). (Assignee)
For primary bibliographic entry see Field 5E.
W81-01452

APPARATUS FOR REMOVING SUSPENDED OIL DROPLETS FROM WATER,
Exxon Production Research Co., Houston, TX. (Assignee)
R. E. Williams.
U. S. Patent No 4,198,300, 6 p, 1 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 986, April 15, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Oily water, Oil pollution, Separation techniques, Bubbles, Coalescence, Equipment, Offshore drilling.

Suspended droplets of oil are separated from a waste water stream by injecting the oil and water mixture into a partially submerged, vertical pipe. Gas bubbles injected into the lower end of the pipe rise through the pipe and countercurrently contact the suspended oil droplets, thereby promoting the separation of the droplets from the waste water. The oil droplets coalesce and form a separate oil layer on top of the waste water which is readily withdrawn while clarified waste water is discharged from the lower end of the pipe. If employed to separate oil from a waste water stream on an offshore rig, the vertical pipe is submerged adjacent to the rig. (Sinha-OEIS)
W81-01454

MICROSCREEN METHOD AND APPARATUS,
Water Pollution Control Corp., Milwaukee, WI. (Assignee).
L. Ewing, and M. J. Bykowski.
U.S. Patent No 4,198,299, 23 p, 18 Fig, 1 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 985-986, April 15, 1980

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Equipment, Vapor pressure, Suspended solids, Flow rates, Gas pressure, *Microscreening.

A limited differential gas pressure is applied across an unsubmerged portion of the screening cloth of a microscreen unit, while rotating the drum, screening and backflushing. Thus, the invention is distinguishable from pressure filtering techniques in which pressure is applied against the submerged area of a filter by pressurizing a confined body of liquid against a filter cake. The invention provides advanced methods and apparatus which are of particular interest for dealing with agglomerated solids. These involve: applying the differential pressure only during periods of peak load on the microscreen, and/or boosting shower pressure during at least a substantial portion of the time during which the differential pressure is being applied and/or off-setting, inhibiting or preventing the application of the applied differential pressure in the zone above the collection means. Drop-back of solids into the drum pool is reduced and the invention enables operation at increased flow capacity. (Sinha-OEIS)
W81-01455

SYSTEM AND APPARATUS FOR CONTROL AND OPTIMIZATION OF FILTRATION PROCESS,
Enviro Development Co., Inc., Mountain View, CA. (Assignee).
M. M. Zuckerman, and L. C. Hamer.
U.S. Patent No 4,198,298, 9 p, 2 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 985, April 15, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Control systems, Sludge, Flow control, *Filtration, Monitoring, Regulation, Equipment.

A process control apparatus and system for dewatering a solids ladened slurry of water and waste water employs one or more of four primary process control techniques, depending upon the particular process application. The four process control techniques are: (1) monitoring of the instantaneous solids concentration increase in the dewatering unit, (2) measurement of the rate of change of the solids concentration increase with respect to time, (3) controlled pumping to produce a substantially constant flow rate in the effluent from the dewatering unit until the terminal dewatering pressure is reached, and (4) variation of the amount of conditioning agents added to the influent slurry in response to one or more control signals derived from other components of the dewatering system and apparatus. (Sinha-OEIS)
W81-01456

REMOVAL OF TRACE COPPER IONS FROM WATER,
Office of the Secretary (Interior), Washington, DC. (Assignee)
E. Valdes-Krieg, J. King, and H. H. Sephton.
U.S. Patent No 4,198,297, 5 p, 1 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 984-985, April 15, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, Metals, Separation techniques, Surfactants, Foam fractionation, Copper, Product recovery.

A method for separation and recovery of metal ions, particularly copper ions, from dilute aqueous solutions by means of a bubble fractionation process employs countercurrent contacting of the feed solution with a stream of gas bubbles and a surface-active agent. This is achieved by utilization of an elongated vertical fractionation column, with feed solution being continuously introduced near the top of the column, and the gas bubbles and surfactant being continuously introduced near the bottom of the column. Surfactant loading at the gas-liquid interface substantially throughout the length of the column is thereby obtained, resulting in improved separation of metal ions from solution in association with the surfactant. (Sinha-OEIS)
W81-01457

PROCESS FOR INCREASING THE EXCHANGE YIELD IN ION EXCHANGE PROCESSES.
Sandor Vajna (Germany, F.R.). (Assignee).
S. Vajna.
U.S. Patent No 4,198,295, 14 p, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 984, April 15, 1980

Descriptors: *Patents, *Waste water treatment, *Desalination, Demineralization, Separation techniques, *Ion exchange, Industrial water, Product recovery, Regeneration.

A process is described for increasing the exchange yield in ion exchange processes. According to the invention, salt-containing waste waters are formed at two locations: with the commencement of the exchange reaction, the ion loss makes up about 2 to 10% of the ion content of the solution supplied from outside, and finally about 0.2 to 4%. These ions are once again found in the secondary waste water leaving the system. For the purpose of eliminating these ions, it is proposed to admix the dilute solutions obtained in addition to the product with the water which is to be treated, as a result of which its salt content increases about 3 to 15%. This causes a corresponding higher consumption of regenerating agent, but the result is thereby obtained that only the concentration is only slightly lower than that of the solution supplied from outside, and the treated water, which can be discarded or used again without any difficulties, emerge from the system. The process can be used not only in connection with treatment of waste water, but also in connection with the removal of salt from brackish water and in connection with the softening or demineralization of raw or untreated water. It is also possible to use the process for the production of chemical products. (Sinha-OEIS)
W81-01459

WATER PURIFICATION SYSTEM,
Redux Corp., Inc., St. Louis, MO. (Assignee).
T. N. Deane.
U.S. Patent No 4,198,294, 8 p, 2 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 984, April 15, 1980

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Industrial wastes, Water reuse, Emulsions, Surfactants, Foam separation, Detergents, *Water purification, Laundry industry

Waste water from a washing operation is reclaimed for re-use by emulsifing with a water insoluble (or oil soluble), high molecular weight, anionic surface active oil, then breaking the emulsion by physical or chemical methods, thereby producing a coherent floc which occludes insoluble matter suspended in the water, then separating the floc from the purified water in a coherent mass. (Sinha-OEIS)
W81-01460

WASTE WATER TREATMENT IN THE MEDITERRANEAN ZONE: STUDY OF VARIOUS SOLUTIONS USED ON THE FRENCH COAST. (PROBLEMES POSES PAR L'EPURATION DES EAUX RESIDUAIRES URBAINES EN ZONE MEDITERRANEENNE -- ETUDE DE DIVERSES SOLUTIONS APPLIQUEES SUR LA COTE FRANCAISE.),
Societe, Rueil-Malmaison (France). Dept. de Recherches Biologiques.
J. Bebin, and J-C. Jacquart.
Progress in Water Technology, Vol 12, No 1, p 403-417, 1980. 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Municipal wastes, *Tertiary treatment, *Sewage treatment, Planning, Regulation, Cities, Tourism, Facilities, Mediterranean, *France.

Several waste water treatment plants on the Mediterranean coast of France are described which utilize various methods to meet French regulations. Physical-chemical treatment has been successful at Cannes and at other sites where available land is limited due to development and tourism. Where fluctuating population levels are a problem, a combination of physical-chemical treatment under peak loading conditions with biological treatment at low or medium loadings is suggested. Advanced treatment may be required in some cases. There is a pilot plant at Montpellier which disinfects thoroughly treated effluent, and in Nice-Lingostiere, advanced tertiary treatment is necessary. Thus, treatment solutions can be found for all areas in spite of problems posed by tourism, geographic location, and socio-economic conditions. (Small-FRC)
W81-01472

EFFECT OF CARBON, AMMONIA NITROGEN AND HYDRAULIC LOADING RATES, RPM, AND EXPOSED SURFACE AREA VARIATIONS ON RBC PERFORMANCE,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
G. E. Hoag, and W. H. Hovey.
In: First National Symposium on Rotating Biological Contactor Technology Proceedings, June, 1980, p 103-117. 9 Tab, Army Construction Engineering Research Laboratory, P.O. Box 4005, Champaign, Ill. OWRT A-081-CONN(1), 14-34-0001-0107.

Descriptors: *Rotating biological contactor, Biological waste treatment, Factorial analyses, Effects of process variation, *Waste water treatment, Performance, Limiting factors, Effects, Carbon, Ammonia nitrogen, Hydraulic loading rates.

Basic and independent factors which possibly effect rotating biological contactor (RBC) effluent quality and performance are hydraulic flow rate, carbon mass flow rate, ammonia nitrogen mass flow rate, percent of disc area exposed to the atmosphere at any given time, and disc revolutions per minute (RPM). These factors were studied in this experimental program. Influent concentrations were not chosen as variables for study because they are not basic factors, but are derived factors, equal to mass flow rates divided by hydraulic flow rates.
W81-01476

MICROFAUNA AND RBC PERFORMANCE: LABORATORY AND FULL SCALE SYSTEMS,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
G. E. Hoag, W. J. Widmer, and W. H. Hovey.
In: First National Symposium on Rotating Biological Contactor Technology Proceedings, June, 1980, p 167-187. 4 Fig, 8 Tab. Army Construction Engineering Research Laboratory, P.O. Box 4005, Champaign, Ill. OWRT A-081-CONN(2), 14-34-0001-0107.

Descriptors: Biological wastewater treatment, Protozoa, *Rotating biological contactor, Microbial ecology, *Waste water treatment, *Biological treatment, Bacteria, Ecology, Ecosystems, *Microfauna.

The transformation of soluble substrate to cells, metabolic products and excreta is the basis of the rotating biological contactor process. Metabolic activities associated with the rotating biological contactor occur in fixed-film, or as they are more commonly termed, biofilm cultures. Bacterial populations exist as a response to combinations of various environmental factors. The sum of all these factors constitute, in an ecological sense, a niche, or a specialized environment suitable for microbial occupation. These saprophytic bacteria are in turn predated by holozoic organisms such as the Phyla: Protozoa, Rotifera and Nematomorpha. Some members of these Phyla may prey upon either bacteria, algae or other members of the above mentioned Phyla. Thus, the niches for these organisms are defined by the presence of other organisms as well as environmental factors.
W81-01477

EFFECT OF PRETREATMENT ON THE FILTRATION OF LOW TURBIDITY SECONDARY EFFLUENT,
Los Angeles County Sanitation Districts, Whittier, CA.
L. S. Directo, C. Chen, and R. P. Miele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-111031, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-148, August, 1980. 85 p, 29 Fig, 11 Tab, 13 Ref. 14-12-150.

Descriptors: *Waste water treatment, *Coagulation, *Filtration, *Suspended solids, *Turbidity, Waste water(Pollution), Costs, Activated sludge, Chemical precipitation, Sewage treatment, Filters, Polymers, Alum.

Removal of residual suspended solids after biological treatment is one of the proven procedures for upgrading waste water treatment plant performance. A 17-month pilot plant study evaluated the relative effectiveness of two types of pretreatment scheme on the performance of multimedia pressure filters in the removal of turbidity, suspended solids, and other associated pollutants from an activated sludge plant effluent. The two types of filter pretreatment schemes studied were a conventional chemical coagulation-sedimentation system and an in-line coagulation system. In both pretreatment schemes, alum and polymer were used. The turbidity removal performance was essentially the same for both dual media and mixed media pressure filters, but the headloss levels across the mixed-media filter were consistently higher than those observed in the dual media filter. The study demonstrated that for a low turbidity secondary effluent, an in-line coagulation pretreatment is feasible and results in significantly lower overall capital and operating costs than that of a conventional pretreatment system. Moreover, it was observed from limited filtration data that without chemical addition, the resulting filter effluent turbidity levels were comparable to those obtained in filters with an in-line coagulation pretreatment system operated at optimum doses of alum and polymer. The lengths of filter run with an in-line coagulation pretreatment were consistently shorter than those observed without chemical addition or with a chemical coagulation-sedimentation pretreatment. (Moore-SRC)
W81-01481

SUMMARY OF LONG-TERM RAPID INFILTRATION SYSTEM STUDIES.
Robert S. Kerr Environmental research Lab., Ada, OK.
L. E. Leach, C. G. Enfield, and C. C. Harlin, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-222086, Price codes: A04 in paper copy, A01 in microfiche Environmental Protection Agency Report EPA-600/2-80-165, July, 1980. 59 p, 7 Fig, 12 Tab, 12 Ref.

Descriptors: *Waste water treatment, *Municipal wastes, *Infiltration, Water pollution, Metals, Iron, Phosphorus, Groundwater, Pesticides, Lindane, Environmental sanitation, Rapid infiltration systems.

Evaluation of four long-term rapid infiltration municipal waste water systems indicates that they are generally operating in conformance with current criteria published in the Process Design Manual for Land Tretment of Municipal Waste waters as well as the proposed design rationale. Two of the systems were applying primary pretreated waste water to infiltration beds and two were applying secondary pretreated waste water. Comparison of treatment efficiency of infiltration beds indicated a higher percentage of removal for selected parameters in the systems with primary pretreatment. Lake George, New York, and Hollister, California, demonstrated exceptional capability for nitrogen removal through the soil treatment systems. Both of these systems were managed using well scheduled wetting and drying cycles. Phosphorus concentration was reduced at each of the treatment sites. Iron appears to be leaching from the profile at all sites, possibly due to reducing conditions developed during flooding cycles. Generally the other metals did not indicate significant differences in concentration between the waste water applied and that reaching the shallow groundwater. The pesticides that were detected in the waste waters were all found in the shallow groundwater, indicating these pesticides are mobile in the soil profile. Lindane was the only pesticide found significantly elevated over background groundwater concentrations. (Moore-SRC)
W81-01485

HUMIC SUBSTANCES REMOVAL BY ACTIVATED CARBON,
Illinois Univ., Urbana-Champaign. Dept. of Civil Engineering.
M. C-Y. Lee, and V. L. Snoeyink.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-163552, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois, Research Report 153, November, 1980. 125 p, 43 Fig, 12 Tab, 52 Ref. OWRT-B-110-ILL(1), 14-34-0001-8083.

Descriptors: *Activated carbon, *Adsorption, *Water treatment, *Environmental engineering, *Humus, Organic compounds, Fulvic acids, Humic acids, Chloroform, Haloforms, Coagulation-sedimentation.

Humic substances are a major concern to the water treatment industry because they can cause odor and color problems and are potentially toxic and/or carcinogenic. A humic acid and a fulvic acid were used to evaluate the removal of humic substances by various activated carbons. Different analytical methods were investigated to measure the concentration of humic substances and their chloroform potential. Total organic carbon measurement and ultraviolet/visible adsorbance correlate well with the chloroform potential of humic substances. Pore size distribution was the most important physical characteristic of activated carbon for adsorption of humic substances. A decrease of pH in solution, lower molecular weight fractions of humic substances, smaller carbon particles, and the presence of soluble alum were found to increase carbon adsorption. Chemical pretreatment with alum increased the adsorption capacity of carbon almost three-fold. The application of a mathematical model to predict the performance of the carbon bed for the adsorption of humic substances was successful. In general, this model is sensitive to values of adsorption capacity of activated carbon and the surface coefficient of humic substances inside the adsorbent particle. The higher the adsorption capacity, the lower the diffusion coefficient. Based on the model predictions, the empty bed contact time of the carbon bed and the influent concentration were the two most important factors in designing a carbon bed for humic substance removal.
W81-01491

THE REMOVAL OF LOW LEVELS OF PHENOL BY ACTIVATED CARBON IN THE PRESENCE OF BIOLOGICAL ACTIVITY,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
W. A. Chudyk, and V. L. Snoeyink.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-163560, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois, Research Report No 154, January, 1981, 110 p, 22 Fig, 9 Tab, 94 Ref. OWRT-B-110-ILL(2), 14-34-0001-8083.

Descriptors: *Water treatment, *Phenols, *Activated carbon, *Biological treatment, Potable water, Biological oxidation of phenol, Phenol removal, Waste water purification, Water reuse.

Bioregeneration of activated carbon was shown to occur in bench-scale carbon columns through use of parallel bacterially seeded and non-seeded, non-bioactive columns. Phenol degrading organisms were taken from an enrichment using phenol as sole carbon source. Mass balance calculations on phenol and dissolved oxygen were used to estimate

amounts of pre-adsorbed phenol being biodegraded under different conditions, with a check made on this amount through the use of adsorption isotherm analysis. The amount of bioregeneration was found to be related to the influent dissolved oxygen concentration. Transient organic load experiments showed that the presence of a bacterial population could affect the effluent concentrations resulting from such transient loadings primarily through two mechanisms: increased carbon capacity due to bioregeneration, and reduction of solution concentration due to biodegradation of phenol in the bulk solution. End product analysis was performed via carbon extraction, gas chromatography, and mass spectroscopy. Total organic carbon analysis of column effluents was also performed.
W81-01492

FEASIBILITY OF PURIFICATION AND CONCENTRATION OF SELECTED WASTE WATER STREAMS BY ULTRAFILTRATION,
Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.
N. Espinoza.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-163610, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis, August, 1980. 68 p, 13 Fig, 24 Tab, 37 Ref. OWRT-A-130-MISS(2), 14-34-0001-0126.

Descriptors: *Waste water treatment, *Filtration, *Organic wastes, *Ultrafiltration, Waste water purification, *Pulp and paper industry, Concentration of waste water, High molecular weight organic wastes, COD, Wood sugars, Membrane processes, Cheese whey, Prehydrolysate, Amicon ultrafiltration unit.

Waste water streams in pulp and paper mills, hardboard plants and cheese whey processing plants often contain significant amounts of high molecular weight organic matter which place a heavy load on the waste water treatment facilities. The purpose of this work was to determine, on a lab scale, the feasibility of using ultrafiltration (UF) to purify and concentrate these wastes. The chemical oxygen demand (COD) reduction of the cheese whey, prehydrolysate and wood sugars permeates ranged from 92 to 97% of the initial values. The initial COD values of 60,000 ppm, 130,000 ppm and 119,000 ppm were reduced to less than 2,000 ppm, 6,000 ppm and 9,000 ppm, respectively. Ultrafiltration was found to be an effective process for purification and concentration of waste water streams. Because of its conceptual simplicity and low energy consumption, the UF membrane process offers an economically attractive solution for treating waste from pulp and paper mills, hardboard plants, and cheese processing plants.
W81-01497

MICRO-ORGANIC COMPOUNDS IN THE WATER ENVIRONMENT AND THEIR IMPACT ON THE QUALITY OF POTABLE WATER SUPPLIES,
Water Research Commission, Pretoria(South Africa).
For primary bibliographic entry see Field 5C.
W81-01505

WASTE WATER DISINFECTION - TOWARD A RATIONAL POLICY,
Johns Hopkins Univ., Baltimore, MD. School of Hygiene and Public Health.
K. Kawata, V. P. Olivieri, and C. W. Kruse.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 416-420, February, 1980. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Water treatment, *Disinfection, *Salmonella, Water quality control, Water purification, Environmental engineering, Chlorination, Environmental sanitation, Public health, *Waste water treatment, Maryland, Baltimore(MD), Black River Treatment Plant(MD).

A study was made of Salmonella and the traditional indicator organisms in the raw waste water and in the chlorinated and unchlorinated plant effluents of the Black River Waste water Treatment Plant of Baltimore City. Waste water samples were held for 14 days and assayed at time intervals to establish the survival patterns of the organisms, in order to supply a reasonable data base for microbial load to downstream water uses. The findings demonstrated that Salmonella may be discharged to receiving waters if the effluent from a conventional waste water treatment plant is not disinfected. This fact, coupled with data demonstrating that underestimation of the concentration of Salmonella is likely to occur, plus the knowledge that techniques for monitoring many pathogens still are being developed, suggests that prudence and caution be exercised and that all plant effluents be disinfected. Exceptions would be only on a case-by-case basis, where it can be shown that the health of the public is not threatened. (Baker-FRC)
W81-01508

WATER RESOURCES FOR CHICAGO-HISTORY AND FUTURE,
Metropolitan Sanitary District of Greater Chicago, Chicago, IL.
F. C. Neil, and F. E. Dalton.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 173-184, March, 1980. 5 Fig, 1 Tab, 2 Ref.

Descriptors: *Waste water treatment, *Storm drains, *Chicago, Reviews, Water pollution, Sewage treatment, Tertiary treatment, Lake Michigan, Storm runoff, Tunnels, Treatment facilities, Sanitary engineering, Public health, Future planning, Aeration, Municipal wastes, Water management, Cities, Chicago River.

A review of Chicago's management of its water resources is presented, with emphasis on measures taken to handle a rapidly increasing population. The Sanitary District of Chicago has increased from its original 409 sq km to 2,243 sq km. When the US Supreme Court declared in 1930 that Illinois was taking more than its share of water from Lake Michigan, Chicago began expansion of its sewage treatment program. Previous attempts to control public health problems from sewage included the reversal of the Chicago and Calumet Rivers away from this Great Lake. The history of pollution problems in the city is reviewed from the time of the city's settlement in the 17th century to the present. The main source of pollution of the Chicago River and Lake Michigan was from untreated sewage discharged from the city. The Metropolitan Sanitary District of Greater Chicago now has 3 major secondary treatment plants and maintains rigid controls over private and industrial treatment systems. Often, low flow rates in the District's waterways cause serious decreases in the levels of dissolved oxygen. Storm runoff usually overloads the sewage systems, and the overflow into the two rivers must be released into Lake Michigan. Pollution of the lake often forces the recreational beaches to close. A ten year plan to improve water quality in the Sanitary District includes building instream aeration systems, upgrading major sewage treatment plants to tertiary treatment, and furnishing an extensive tunnel and reservoir system to handle storm overflows. Attempts will also be made to eliminate backflows to Lake Michigan, which will prevent pollution of this water body by the city. (Geiger-FRC)
W81-01509

DECLINING-RATE VERSUS CONSTANT-RATE FILTRATION,
Sao Paulo Univ. (Brazil). Dept. of Hydrology and Sanitation.
L. Di Bernardo, and J. L. Cleasby.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE6, p 1023-1041, December, 1980. 11 Fig, 3 Tab, 13 Ref.

Descriptors: *Filtration, *Flow rates, Performance, *Water treatment, Waste water treatment, Turbidity, On-site investigations, Equipment, Flow profiles, Declining rate filtration, Backwash, Pressure head.

The advantages of a declining rate system were demonstrated when declining rate filtration was compared to constant rate filtration at three filtration rates: 3 gal/min/sq ft, 5 gal/min/sq ft, and 7 gal/min/sq ft. The declining rate system produced an average filtrate turbidity which was consistently and substantially better than that of the constant rate system. The declining rate system produced 30-60% lower average filtrate turbidity. The poorest effluent quality of the declining rate system occurred after backwashing one filter, and the highest filtration rate occurred on the cleanest filter remaining in service during the backwashing operation when water reached its maximum level. The filtration rates in the individual filters of the declining rate system remained constant between backwashings and declined in a stepwise fashion after each backwash. (Small-FRC)
W81-01532

ROTATING-DISC BIOLOGICAL TREATMENT OF ACID MINE DRAINAGE,
Tennessee Valley Authority, Chattanooga.
H. Olem, and R. F. Unz.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 257-269, February, 1980. 10 Fig, 6 Tab, 17 Ref.

Descriptors: *Acid mine water, *Mine drainage, *Biocontrol, Acidic water, Mine water, Water types, Acid streams, Mine wastes, Biological treatment, Water treatment, *Waste water treatment.

The study was conducted to determine whether naturally occurring bacteria in acid mine drainage (AMD) would effectively and efficiently oxidize Fe2+. Specific objectives of the study included the treatment of AMD of contrasting physical, chemical and microbiological characteristics; a comparative performance evaluation of different size rotating biological contactor (RBC) units for determining potential scale-up problems in design and operation of the process; and requirements for treating specific drainages and necessary modifications to accomplish desired effluent quality. Under all conditions tested the continuous microbiological oxidation of Fe2+ to less soluble Fe3+ was accomplished. Mine-water temperatures as low as 0.4 degrees C reduced but did not stop Fe2+ oxidation in field RBC units. The 0.5 m RBC unit produced an average of 10% higher Fe2+ oxidation efficiency than the 2.0 m unit. No relation was noted between Fe2+ oxidation efficiency and influent pH over the pH range of 2.18 to 5.50. Lower influent Fe2+ in Hollywood mine drainage (71.6 mg/l) resulted in a higher oxidation efficiency at equilibrium for the 2.0 m prototype RBC (95.7%) as compared with the treatment efficiency when mine water contained about twice the influent Fe2+ content (90.5%). Under similar operating conditions, Fe2+ oxidation efficiencies in the treatment of Hawk Run mine waters with the RBC field units were 10 to 15% lower than treatment efficiencies observed with Hollywood mine drainage, which may be due to differences in the nature of disc solids. (Baker-FRC)
W81-01540

START-UP PROBLEMS AT A PLANT TREATING FOOD-PROCESSING WASTEWATER,
Metcalf and Eddy, Inc., Boston, MA.
E. L. Stover.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 249-256, February, 1980. 5 Fig, 6 Ref.

Descriptors: *Food processing industry, *Waste water treatment, Industries, *Industrial wastes, Pollutants, Activated sludge, Operations, Carbohydrates, Slime.

Operational difficulties associated with the start-up of an industrial wastewater pretreatment plant treating a highly variable carbohydrate wastewater by the complete-mix activated sludge process are described. The operation consists of wastewater neutralization, two dissolved air flotation units, a complete-mix equalization basin, a complete-mix aeration basin, a final clarifier, and an aerobic digester. The system functions as a two-stage system, with the equalization basin also serving as the first stage of biological treatment. High point in both wastewater flow and organic load correspond

to cleanup operations at the end of the production week. Two major problems caused by the organic shock loading conditions were encountered during the start-up of the plant. The fluctuations in wastewater flow rate did not present operational problems, as these changes could be handled by the equalization basin while a constant flow to the aeration basin was maintained. During nitrogen-deficient conditions in the equalization basin caused by doubling of the organic loading, bacterial cell replication was retarded, and the bacteria capable of producing extracellular polysaccharide began producing large amounts of polysaccharide slime. The equalization basin was reseeded with biological sludge from the aeration basin and with domestic treatment plant sludge to reduce the slime biologically. (Baker-FRC)
W81-01541

SELECTED ORGANIC PESTICIDES, OCCURRENCE, TRANSFORMATION, AND REMOVAL FROM DOMESTIC WASTEWATER,
North Texas State Univ., Denton.
F. Y. Saleh, G. F. Lee, and H. W. Wolf.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 19-28, January, 1980. 3 Fig, 7 Tab, 16 Ref.

Descriptors: *Waste water treatment, *Chlorophenoxy herbicides, *Pesticides, Chlorinated hydrocarbon pesticides, Activated carbon, Aldrin, 2,4-D, Dieldrin, DDT, Water pollution, Domestic water, Domestic wastes.

Results are presented of a study on the occurrence, transformation, and removal of chlorinated hydrocarbon pesticides (CHP) and chlorophenoxy herbicides (CPH) from Dallas, Texas municipal wastewater. The pilot plant used in the study includes two completely mixed activated sludge units (aeration basins and final clarifiers), a chemical treatment module, two mixed-media filters, and two activated carbon columns. Throughout the study period, electron capture gas chromatography of the wastewater demonstrated the resolution of 20 to 25 peaks having relative retention time (Rr) values less than 1.3. Only minor changes were noted in the number of peaks during the study period. The finding of the same characteristic fingerprints in higher magnitude in extracts of raw and treated wastewater indicates the refactory nature of the organic pesticide and herbicide residues and indicates that each area has a profile characteristic of the activities which infiltrate the system. Confirmation in wastewater was attained for aldrin, dieldrin, o,p'-DDT, p,p'-DDT, 2,4-D alkyl esters, and inorganic salts of 2,4-D. The chlorinated hydrocarbons aldrin, dieldrin, and DDT compounds represent only a minor fraction of the CHP residues. The major part was the 2,4-D compounds, which are commonly used in lawn and aquatic weed control. The results of the study indicate that activated sludge treatment of wastewater under nitrifying conditions effected only limited removal of these organic residues as detected on EC chromatograms. (Baker-FRC)
W81-01543

HYDRAULIC CONSIDERATIONS IN DECLINING-RATE FILTRATION.
Iowa State Univ., Ames.
J. L. Cleasby, and L. Di Bernardo.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE6, p 1043-1055, December, 1980. 4 Fig, 7 Ref.

Descriptors: *Filtration, *Flow rates, Turbidity, Filters, Equipment, Head loss, Flow profiles, Water treatment, *Waste water treatment, Declining rate filtration, Pressure head.

The six most common hydraulic questions are answered for declining rate filtration systems. Declining rate filtration can be used as a flow system for granular bed gravity filters in water and waste water treatment plants. Head loss for the system is the sum of the clean filter head loss when the filters have dropped to level 2 after the backwash of one filter, plus the rise in level which occurs between backwashes from level 2 to level 3, and the rise in level which occurs during the backwash of one filter. Excessive rates of filtration through a clean filter are prevented by a flow restricting orifice or a fixed position valve. Predicted water level variations are presented, and the effect of turbulent head loss on filter operation is discussed. A declining rate system can operate with low turbulent head loss if the maximum water level is limited to avoid excessive rates on a clean filter Declining rate can be operated under varying plant load by washing filters at various times throughout the day. Full understanding of the declining rate system should make it more common. (Small-FRC)
W81-01550

EFFECTIVENESS OF LAND APPLICATION FOR PHOSPHORUS REMOVAL FROM MUNICIPAL WASTE WATER AT MANTECA, CALIFORNIA,
Cold Regions Research and Engineering Lab., Hanover, NH
I. K. Iskandar, and J. K. Syers.
Journal of Environmental Quality, Vol 9, No 4, p 616-621, October/December, 1980. 4 Fig, 4 Tab, 18 Ref.

Descriptors: *Waste water treatment, *Sorption, Soil treatment, Soil filters, Soil disposal fields, Phosphorus, Municipal wastes, *Phosphorus removal.

The effectiveness of removal of dissolved inorganic phosphate (DIP) from municipal waste water by slow infiltration systems such as the one at Manteca, California, is evaluated. The design flow rate at the sewage treatment plant is 9.5 million liters/day. When necessary, waste water is stored in a holding pond. Perennial ryegrass makes up the major vegetation of the area. Most of the waste water applied at the site infiltrates to the ground water table. While ground water flows in a southwesterly direction toward a river, it is likely that a substantial portion of the water is intercepted by a major drainage ditch that bounds the north, west, and south sides of the disposal area. Three sets of monitoring wells were installed during the initial construction. Samples were collected in June, September, and November of 1974 and again in February, May and July of 1977. DIP concentrations in soils that had received municipal wastewater for 4 and 13 yr ranged form 7.3 to 13.9 micrograms P/ml. The ability of the soil to remove added P was low. Only a small portion of the total P accumulated from waste water addition was in the organic form. Calcium chloride was able to remove large amounts of P from the upper 45 cm of the profiles receiving waste water. The very low P sorption capacity of the soil is regarded as the major factor for the poor performance of the Manteca system in terms of P removal from waste water. (Baker-FRC)
W81-01551

SEWER RENOVATION--SOLUTIONS FOR THE 80'S.
Water Services, Vol 84, No 1016, p 625-626, October, 1980. 1 Fig, 2 Tab.

Descriptors: *Insituform process, *Linings, *Sewers, *Pipes, *Rehabilitation, Costs, Repairing, Construction costs, Conveyance structures, Cost comparisons, Manholes, Comparative costs, Sewage disposal, District of Columbia, Dublin.

The most economical methods of renovating sewer systems involve relining existing pipes. After asbestos cement sewer pipes in a Dublin housing development were discovered not in compliance with local standards, the Insituform process was chosen to reline existing pipes and eliminate groundwater infiltration. The process used flexible, strong, and chemically inert pipe lining installed in sections and grouted in place. Although the inside diameter of the pipe was reduced by 12 mm, flow characteristics were improved by the smooth lining. Total costs of inspection, relining, etc. were 9,423 pounds compared with the estimated 25,000 pounds for reexcavating and replacing the defective system. Comparable work done in Washington, D. C., showed that pipes from 150 to 600 mm diameter were installed for about 50% of costs necessary to dig up and replace old pipes. (Cassar-FRC)
W81-01559

FLOW SPLITTING CONTROL,
A. M. Crossley.
Water Services, Vol 84, No 1016, p 608, 610, October, 1980. 3 Fig

Descriptors: *Flow control, *Instrumentation, *Control systems, *Flow splitting, *Waste water treatment, Activated sludge, Flow measurement, Penstocks, Flowmeters, Remote control, Gradually varied flow, Inflow, Flow separation

Flow splitting in a waste water treatment plant is an attempt to distribute the incoming flow equally to each treatment lane, even if the total flow varies. This differs from flow balancing, which attempts to maintain a constant flow to treatment throughout the day. Design of flow splitting equipment should consider flow measurement, flow control, flow-loop control, and flow splitting control If traditional flowmeters are not suitable, there is an experimental device consisting of a Doppler sensor head and an ultrasonic level meter. Penstocks used in flow control may be modified by adding a remote actuator. Proper design of flow splitting control systems is based on diverting flow into appropriate channels rather than restraining it from channels. Although flow into the primary treatment plant is considered in this paper, the possibility of use in return of activated sludge is mentioned. (Cassar-FRC)
W81-01560

COST-EFFICIENT DESIGN SOLVES TOWN'S PROBLEM.
Camp, Dresser and McKee, Walnut Creek, CA
S. Goodman, and D. Trumball
Water and Wastes Engineering, Vol 17, No 11, p 31-35, 50, 51, November, 1980. 2 Fig, 3 Tab.

Descriptors: *Industrial wastes, *Municipal wastes, *Sludge treatment, Rotational flow, Inflow, Waste water treatment, Effluents, Sewage effluents, Primary treatment, Secondary treatment, Sewers, Drainage systems, Water quality control, Design, Infiltration, Crescent City(CA), California, Food processing industry.

A cost-efficient design for sewage system improvements in Crescent City, California, is described The design addressed the problems of an overloaded primary treatment plant, an aging sewer system, a central urban location, waste discharge standards, and accommodation of nuisance wastes from seafood industries. The design consisted of a three-pronged plan, cost-effective in both capital outlays and continuing expense. An on-site pre treatment plan was developed for seafood wastes, which included hauling screened wastes to a landfill. Correction and repair of storm inflow sources accompanied by a surveillance program eliminated infiltration/inflow. The existing primary treatment facility was upgraded and expanded to include a secondary treatment process using rotating biological contactors and a two-stage sludge digester This system has the benefits of simple operation, low power consumption, minimal maintenance requirements, good sludge settleability, potential for nitrification, control of odors, and the ability to handle shock loads and high industrial loads. (Titus-FRC)
W81-01569

WETLANDS IRRIGATION AIDS MAN AND NATURE.
T. C. Williams
Water and Wastes Engineering, Vol 17, No 11, p 28-31, November, 1980. 2 Fig.

Descriptors: *Irrigation design, *Wetlands, *Marshes, Pilot plants, *Michigan, Operation and maintenance, Irrigation practices, Irrigation engineering, *Waste water treatment, Freshwater marshes, Wildlife, Game birds, Construction costs.

Two wetlands in Michigan, one natural and one artificial, are successfully used for irrigation of

treated effluent from waste water treatment facilities. During a 4 to 6 month irrigation season, an average of 85 million gallons per day of effluent containing 4 milligrams per liter of phosphorus, 0.6 milligrams per liter of ammonia and 5.4 milligrams per liter of nitrate nitrogen results in a high level of treatment. The wetlands require little or no maintenance, less isolation than spray irrigation areas, and have lower manpower and energy costs than conventional systems. This system has potential application for strip mines and other barren lands or areas lacking viable marsh habitat for recreational game. (Titus-FRC)
W81-01574

POLLUTION SOLUTIONS--THE CATIOPHORETIC PAINT INDUSTRY.
Effluent and Water Treatment Journal, Vol 20, No 10, p 506-507, October, 1980. 2 Fig.

Descriptors: *Paints, *Industrial wastes, *Froth flotation, *Water pollution treatment, Lead, Protective coatings, Coatings, Sewage treatment, Waste water treatment, Flotation, Flocculation, Coagulation, Foaming, Sludge, Separation techniques.

Catiophoretic paints used for electrocoating car and appliance bodies have a density near that of water, making sedimentation of the waste waters impractical. A flotation process has been developed which combines liquid-solid-gas phases in variable proportions. After coagulation and flocculation of the paint-contaminated water, air is added to the system by mixing with water previously saturated with air under pressure, producing microbubbles, 20-80 micrometers in diameter, upon controlled depressurization. These bubbles carry the particles to the surface, where they form a flocculated sludge. Treated effluent contained less than 3 mg per liter soluble lead, reduced from 250 mg per liter, and less than 100 mg per liter suspended solids. If paint concentration exceeds 1,500 mg per liter, prior dilution may be necessary. Sodium carbonate is used to raise the pH to prevent polymerization of the particles at the point of injection. (Cassar-FRC)
W81-01580

PERFORMANCE OF SOME OIL DISPERSANTS ON OIL SLICKS OF VARYING THICKNESS,
British Petroleum Co. Ltd., Sunbury-on-Thames (England).
D. G. Meeks.
Marine Pollution Bulletin, Vol 11, No 12, p 348-352, December, 1980. 6 Fig, 3 Tab, 1 Ref.

Descriptors: *Oil pollution, *Dispersion, *Water pollution treatment, *Emulsifiers, Ultimate disposal, Disposal, Biodegradation, Sea water, Laboratory tests, Water pollution sources, *Oil spills, Oil dispersants, Emulsions.

Effects of oil dispersants were studied on 50 g samples of a fuel oil-kerosine mixture in a laboratory apparatus based on a Perspex tank with agitation. This tank is similar in size to a household aquarium. The purpose of the study was to explore the possibilities of the method and to relate this work to the original method and to other laboratory testing procedures within the industry. Commerical dispersants such as BP 1100WD performed well. A 5-10 minute static soaking time using the dispersant as a 10% emulsion yielded low efficiencies. A soak time of at least 5 minutes improved effectiveness of BP 1100X. Doubling the film thickness (from 5 mm to about 10 mm) dropped the dispersing efficiency of BP 1100X on heavier oils to a level unlikely to be effective in real spill situations. However, the kerosine-fuel oil mixture dispersed even at a 12 mm thickness. Increasing the amount of dispersant applied to a slick increased performance. Possible procedures for practical spill situations are injection or booming and flooding of the slick and ruptured tanks with solvent based dispersants or use of aircraft to apply undiluted dispersant. (Cassar-FRC)
W81-01600

FORMATION, PREVENTION AND BREAKING OF SEA WATER IN CRUDE OIL EMULSIONS 'CHOCOLATE MOUSSES',
Shell Research B. V., Amsterdam (Netherlands).
A. L. Bridie, Th. H. Wanders, W. Zegveld, and H. B. Van Der Heijde.
Marine Pollution Bulletin, Vol 11, No 12, p 343-348, December, 1980. 8 Tab, 3 Ref.

Descriptors: *Oil spills, *Emulsions, *Water pollution treatment, Oil pollution, Water pollution sources, Emulsifiers, Chocolate mousses, Waste water treatment, Transportation, Sea water, Ships, Mousses, Laboratory studies.

'Chocolate mousses,' brown, highly viscous, stable emulsions of about 70% sea water in oil, are a result of shipping accidents and other releases of crude petroleum at sea. An emulsifier, designated LA 1834, was successful in laboratory scale and field trials as a 'mousse-breaking' chemical. During salvage and cleanup following an explosion aboard the tanker, Irene's Serenade, off the Greek coast, addition of 200-400 g of the additive per 200 liter drum reduced the viscosity so that the material was easily loaded and unloaded into disposal trucks. On storage, the emulsion lost much of its water content. The formation and properties of mousses were studied by making sea water emulsions with several crude oils and fractions. Emulsions formed by fractions with initial boiling points of 200 C were stable at 20 C and lower; those made with fractions with initial boiling points of 275 C were stable at 30 C and lower. Experiments showed that paraffin wax and asphaltenes were responsible for the stability of mousses. (Cassar-FRC)
W81-01601

RELATIONSHIP BETWEEN PHOSPHATE STRESS, EFFLUENT QUALITY, AND OBSERVED CELL YIELD IN A PURE-OXYGEN ACTIVATED-SLUDGE PLANT,
Gent Univ. (Belgium). Lab. for General and Applied Microbial Ecology.
W. Verstraete, and W. Vissers.
Biotechnology and Bioengineering, Vol 22, No 12, p 2591-2606, December, 1980. 4 Fig, 5 Tab, 14 Ref.

Descriptors: *Phosphates, *Activated sludge, *Oxygenation, *Industrial wastes, *Waste water treatment, Phosphorus compounds, Waste treatment, Organic wastes, Effluents, Sludge digestion, Operating costs, *Belgium.

An industrial waste treatment plant at the BP Chemicals Belgium Works was tested under 3 conditions--nonstress, continuous phosphate stress, and discontinuous phosphate stress-to determine the effects of these factors on sludge production and effluent quality. The system, which has a 3,000 cu m per day capacity, used pure oxygen in an activated sludge process with pH adjustments and ammonia and phosphate additions. Best results were produced by the discontinuous phosphate stress condition, in which the minimum daily phosphate dose was provided in two stages, at the initial stage and during a 3 hour period later in the day. Cell yield coefficient and sludge production was 45% below normal, and total operating cost reduction was 24%. The high quality effluent produced had excellent settling properties. Although the continuous phosphate stress conditions reduced sludge production by 36%, effluent quality was not improved. (Cassar-FRC)
W81-01606

SEPARATION OF URANIUM FROM NATURAL WATERS ON CHELEX-100 RESIN,
Australian Atomic Energy Commission Research Establishment, Lucas Heights.
P. Pakalns.
Analytica Chimica Acta, Vol 120, p 289-296, November, 1980. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Uranium, *Water analysis, Sea water, Analytical techniques, Ion exchange, Separation techniques, *Water treatment, Separation techniques.

Uranium can be separated from fresh and saline waters on Chelex-100 resin by adjusting the pH of the sample to 4.0 after addition of 1,2-diaminocyclohexanetetraacetic acid. After elution with 2 M nitric acid, uranium is determined either by the spectrophotometric 4-(2-pyridylazo)-resorcinol method (preferable for high levels) or the fluorometric method (preferable for microgram per liter levels). Phosphate at 25 to 500 micrograms does not interfere if thorium nitrate is added before the resin separation step. Best uranium recovery (93%) is obtained when the resin column is maintained at pH of 4.6 by addition of sodium acetate, acetic acid buffer. Surfactants, sodium tripolyphosphate, and complexing agents reduce recoveries to 84-91%. Vanadium interferes with the spectrophotometric method, but not the fluorometric method. Uranium was concentrated on the resin without prior acidification and with and without the complexing step at a recovery rate of 90%. Levels obtained were 3.5 and 3.4 micrograms per liter. (Cassar-FRC)
W81-01616

SEEKING A SOLUTION TO MULTIPLE SEWER PROBLEMS,
Wegman Engineers, New York.
G. R. Schevon.
Public Works, Vol 111, No 2, p 60-62, February, 1980. 3 Fig.

Descriptors: *Diversion tunnels, *Sewage treatment, *Interceptor sewers, Water pollution, *Waste water treatment, Tunnel design, Tunnel construction, Urban drainage, Storm runoff, Costs, Sewage effluents, Sanitary engineering, Model studies, Computer models, Sewage disposal, Environmental sanitation, *Buffalo(NY).

A study of the Buffalo Sewer Systems was initiated in 1970 to address the problems besetting the facilities serving 402,000 people. Raw sewage had been discharged into the Scajaquada Drain, the enclosed portion of Scajaquada Creek, for many years, causing pollution of the creek. A weir and an inlet grate structure were installed in the Drain to divert creek waters to an outfall sewer connected to the city's main interceptor. Water from sewage effluent discharged by Cheektowaga, Buffalo's upstream neighbor, was also intercepted by the treatment plant. Creek water also flowed into the Delaware Park Lake, a recreational lake downstream from the treatment plant, which had to be closed to the public in 1958 due to unsanitary conditions. Intrusion of waters from the Black Rock Canal and storm overflows also added to the treatment burden of the city's main plant. A Road Research Laboratory model, a computerized stormwater management model for highly urbanized areas, was applied to the problems of the Buffalo city sewage system. The master sewer plan which was developed recommended the transporting of raw sewage from Cheektowaga to Buffalo's new secondary treatment plant. It was also suggested that all sewage discharging into the Scajaquada Drain should be intercepted. To accomplish this, a tunnel interceptor was proposed which would carry sewage by gravity flow from the creek at the easterly city line to the Niagara Street interceptor at Squaw Island. The tunnel would be between 40-60 feet below the ground with a 9 foot diameter bore and a 9 inch concrete lining. Estimated costs of $34,750,000 would be covered by federal funding. Tunnel boring began in September of 1979 and completion of the project is anticipated early in 1981. (Geiger-FRC)
W81-01630

NO NONSENSE MANAGEMENT: KEY TO SUCCESSFUL WASTEWATER PLANT OPERATION,
Toledo, OH. Water Reclamation Div.
K. Keil, P. Munn, and H. Bhatt.
Public Works, Vol 112, No 1, p 61-64, January, 1981. 1 Fig.

Descriptors: *Activated sludge, *Administration, *Operation and maintenance, *Waste water treatment, Treatment facilities, Planning, Personnel, Performance, Municipal wastes, Industrial wastes, Ohio, *Toledo(OH).

Sound management techniques were used to improve the performance of the large waste water

treatment plant in Toledo, Ohio. Operation and maintenance costs were also reduced at the 100 mgd plant. The facility employs the activated sludge process and receives municipal wastes, storm water, and industrial wastes. A new commissioner of the division of water reclamation instituted a cost accounting system and a preventive maintenance program, made efforts to reduce chemical and energy consumption, began a training and safety program for division personnel, and let a new contract for sludge hauling and land spreading. These policies caused significant improvements over a period of two years. For example, four primary digesters were cleaned for the first time in ten years, resulting in a marked difference in digester operation. Also, to avoid breakdowns which had been common, the 10 primary and 11 secondary clarifiers are systematically cleaned and inspected twice a year. Operating costs were reduced in part by eliminating unnecessary personnel and controlling purchasing. (Small-FRC)
W81-01631

GAC WATER TREATMENT SYSTEMS,
Culp/Wesner/Culp, El Dorado Hills, CA.
R. L. Culp.
Public Works, Vol 111, No 2, p 83-87, February, 1980. 5 Fig, 1 Tab.

Descriptors: *Water treatment, *Operating costs, *Activated carbon, Pilot plants, Waste water treatment, Tertiary treatment, Potable water, Organoleptic properties, Color, Odor, Water treatment, Project planning, Organic compounds, Design data, Model studies, Safety factors, Taste, Public health.

Little design or cost data has been available on the granular activated carbon (GAC) treatment of public water supplies, a practice employed in approximately 46 cities of the United States for control of taste, odor, and color. Many of the problems encountered with GAC treatment have been mechanical. Five GAC performance studies are currently being sponsored by the EPA to yield GAC performance and cost data on reactivation at water supply installations. Twenty to thirty GAC plants for food processing will give insight to design and safety factors of the process and a similar number of facilities for industrial water pollution control will yield operation and cost data for this application of GAC systems. Pilot plant studies of GAC adsorptive and reactivation properties in municipal water treatment installations may be combined with known costs of GAC systems in waste water treatment to give design models and estimates of preliminary costs which are appropriate for developing new water treatment facilities. (Geiger-FRC)
W81-01632

BACTERIAL SUPPLEMENTATION AIDS WASTE WATER TREATMENT,
Arvada Public Works Dept., CO.
C. Gardner.
Public Works, Vol 111, No 3, p 71-72, March, 1980. 1 Tab.

Descriptors: *Waste water treatment, *Sewage bacteria, Lipids, Sludge digestion, Cultures, Odor, *Biological treatment, Industrial wastes, Biochemical oxygen demand, Colorado, Temperature, Trickling filters, Municipal wastes, *Arvada(CO).

Problems of grease digestion at the Arvada waste water treatment plant, Colorado, due to the destruction of bacterial action by industrial wastes were handled by a program of bacterial supplementation. Type A DBC Plus dried bacterial cultures were added along with wetting agents and buffers to plant influent after grit removal at rates of 14 pounds/day for 10 days, and afterwards additions were gradually decreased. Occasional industrial discharges of chromates have periodically halted the system, but the operations have been altered to recover these compounds. Since the new system has been in operation, effects of cold weather on BOD and suspended solids reduction have not been as severe, and odor has been reduced. Complete digestion of sludge has also helped to prevent some of the odor problems. After 9 months of operation, a line that used to clog continuously with grease due to restaurant wastes required no additional maintenance other than the supplemental bacterial treatment. The technique allows in-house management and regulation of environmental conditions affecting treatment processes. (Geiger-FRC)
W81-01638

URBAN AND AGRICULTURAL DEVELOPMENT: THE WASTE WATER ROLE,
B. Christopher.
Public Works, Vol 111, No 4, p 65-66, April, 1980.

Descriptors: *Water reuse, *Soil amendments, *Irrigation programs, Irrigation water, Imparied water use, Waste water treatment, *Reclaimed water, Colorado, Sludge disposal, Reservoirs, Water storage, Local governments, Federal government, Water resources development.

A water reuse program has been operating successfully in Westminster, Colorado, wherein secondary treatment plant effluents are used by farmers for irrigation water in exchange for their allotted amount of canal-supplied irrigation water which may have been reduced in periods of water shortages. The system, which has been in operation since 1977, utilizes the pumping of water from the treatment facility to the Farmer's High Line Canal two miles away. The city draws water from Standley Lake when it is needed without purchasing additional water rights. An expansion of the treatment plant scheduled to be completed in 1982 will provide the city with 3,000 acre feet of water annually. Pumping of potential irrigation water to the system will substantially reduce the costs that the city would have had to pay to purchase raw water. Local courts have addressed the parameters of the exchange system, and precedents will decide the ultimate potentials of the reuse program. A reservoir to store effluents generated in the winter is planned so that farmers may begin to use the supply for irrigation during spring planting in April and May. Liquid sludge has also been injected into cultivated farmland, eliminating all the sludge from the city's operation and avoiding the need for expensive landfilling. Higher yields of corn were reported from sludge amended plots, which were attributed to increased nutrients and mulching effects. Daily quality tests have been conducted by local farmers and city and state health officials. The cooperation of the city water treatment facilities with local farmers has received praise from all sectors of government. (Geiger-FRC)
W81-01640

AUSTIN'S INTERCEPTOR AND TREATMENT PLANT: ENGINEERING WONDER,
Water and Waste Water Dept., Austin, TX.
For primary bibliographic entry see Field 8A.
W81-01641

CONTROLLING AMMONIA IN WASTE WATER EFFLUENTS,
Environmental Protection Agency, Chicago, IL.
D. H. Stoltenberg.
Public Works, Vol 111, No 2, p 72-73, February, 1980. 2 Fig, 2 Tab, 3 Ref.

Descriptors: *Ammonia, *Nitrification, *Activated sludge, Aeration, Biological treatment, Nitrate, Nitrite, Temperature, Hydrogen ion concentration, Dissolved oxygen, Biochemical oxygen demand, Organic compounds, Metals, Flocculation, Aerobic bacteria.

Ammonia nitrogen is undesirable in waste water treatment plant effluents due to its toxicity to fish, its high oxygen demand and its ability to combine with chlorine to form chloramines. The activated sludge process can biologically convert ammonia to nitrite and nitrate by nitrification. Favorable temperatures for nitrifying bacteria are in the range of 5-30 degrees, with more efficient processing occurring in the summer than in the winter. Dissolved oxygen conditions in aeration tanks should be maintained at 2.0 mg/liter or above, and the optimum pH for nitrification is 8.4 and should not fall below 7.0. To require nitrification, the ammonia nitrogen concentration of an influent waste water should be more than 1 mg/liter at all times. Toxic metals and organics may also interfere with the nitrification process. Conventional activated sludge processes are usually well suited to biological nitrification. Contact stabilization is generally not adequate for nitrification, because insufficient biological mass in the contact tank often produces incomplete removal of ammonia by the floc. (Geiger-FRC)
W81-01644

OPERATIONAL EXPERIENCE WITH AERATED LAGOONS,
Hawksley (Watson) Consulting Engineers, High Wycombe (England).
H. R. Oakley.
Progress in Water Technology, Vol 11, No 3, p 239-242, 1980. 2 Fig, 2 Tab.

Descriptors: *Aerated lagoons, *Sewage lagoons, *Operatings, Costs, On-site investigations, Performance, Baffles, Settling basins, Aeration, *Sewage treatment.

Operating experiences with two aerated lagoons with integral settlement zones are described. One, in the Middle East, treats settled sewage to a nitrified standard suitable for limited reuse applications. The second, in the Far East, treats crude sewage to a standard suitable for sea discharge. Initially some difficulties were experienced in obtaining adequate settlement in the settling zones, but this was corrected through modifications to the baffle. This form of treatment has low capital costs but high power consumption and high operating costs. Thus, these lagoons are most successful when used for short-term temporary works and should be of the simplest construction possible. The main process design parameters are presented. The initial operating results of the Middle Eastern lagoon included: effluent BOD 16 of mg/liter, effluent suspended solids of 21 mg/liter, and effluent NH3N of 1 mg/liter. (Small-FRC)
W81-01645

CONVENTIONAL BIOLOGICAL FILTERS AT ULTRA-HIGH LOADINGS AS MAIN PROCESS STAGE FOR A STRONG MIXED WASTE,
Ninham Shand, Inc., Cape Town (South Africa).
H. C. Blersch.
Progress in Water Technology, Vol 12, No 3, p 243-249, 1980. 3 Fig.

Descriptors: *Filtration, *Rocks, Biochemical oxygen demand, Filters, *Canneries, *Waste water treatment, Industrial wastes, Sedimentation, Aeration.

Very highly loaded two-stage stone media biological filters are part of a 35,000 cu m/day treatment plant treating waste which originates largely from fruit canneries. The biological filters have a diameter of 30.5 m and a depth of 2.7 m, and use rounded river pebbles as the filtering media. The waste piped from the industrial sites has a BOD of 1,200 to 1,400 mg/liter. Little increase in BOD removal is obtained at loadings exceeding 4 kg/cu m/day in these coarse media filters, but the filters will tolerate loadings exceeding 6.0 and will produce an effluent acceptable to fine media filters at such high loadings. The optimum ratio of primary to secondary filter volumes was approximately 1.0 : 1.1 for maximum combined removal capacity. With two-stage filters in this ratio, BOD removal will be 1.6 kg/cu m/day at loadings per cu m of combined media volume of 2.2 kg/day (70% removal). After evaluations of full scale performance data, the following treatment sequence was adopted: (1) Primary sedimentation, (2) Two-stage biological filtration, (3) A mechanically aerated lagoon with 10 days retention during peak flow, and (4) Existing treatment ponds. (Small-FRC)
W81-01646

THE WULKATAL TREATMENT PLANT - COMBINED TREATMENT OF FOOD PROCESSING WASTES BY A LOWLY LOADED ACTIVATED SLUDGE PROCESS,

Amt der Burgenlandischen Landesregierung, Eisenstadt (Austria).
W. Stalzer.
Progress in Water Technology, Vol 12, No 3, p 251-261, 1980. 4 Fig, 6 Tab, 8 Ref.

Descriptors: *Waste water treatment, *Aeration, *Chemical precipitation, *Activated sludge, Treatment facilities, Municipal wastes, Industrial wastes, *Food processing industry, Canneries, Costs, Energy, Austria.

Extended aeration with simultaneous precipitation (Fe++) was used to treat municipal sewage, effluent from a canning operation, and effluent from a sugar beet processing plant. Variation in load ranged from 300 kg BOD5/day to 9000 kg BOD5/day. Excellent effluent concentrations were obtained: 8.6 mg/liter BOD5, 19.5 mg/liter COD, 6.9 mg/liter total coliforms, 0.7 mg/liter NH4-N, 15.2 mg.liter NO3-N, and 1.4 mg/liter PO4-P. Despite no controlled denitrification and full nitrification, 45% total-N was removed as well as 90% total P. Sixty to 70% of influent COD load contributed to respiration, and 25 to 35% was incorporated into excess sludge. Specific energy consumption for the plant was 1.6 kWh/kg BOD5. The plant required a small staff and produced a small amount of excess sludge. Disadvantages included the high energy requirements and higher construction cost compared to more highly loaded plants. (Small-FRC)
W81-01647

5E. Ultimate Disposal Of Wastes

INSTALLATION FOR TREATMENT OF SEDIMENTS COMING FROM STATIONS FOR PURIFICATION OF INDUSTRIAL WASTE WATER,
Regie Nationale des Usines Renault, Boulogne-Billancourt (France). (Assignee).
M. Petiot.
U. S. Patent No 4,198,914, 4 p, 1 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 4 p, 1194, April 22, 1980.

Descriptors: *Patents, *Waste water treatment, *Sediments, *Industrial wastes, Sludge, Sludge disposal, Incineration, Industrial plants.

An installation for the treatment of sediment coming from a purification station for industrial waste water consists of a static furnace incinerator into which sediment is transferred by means of an injector. The injector is made up of an elbow tube connected between the furnace and the sediment, a blast pipe injecting air into the furnace and drawing sediment with it due to the vacuum created by the blasted air flow, and an additional air inlet in the furnace wall, the additional air inlet surrounding the elbow. The combustion of this detritus proves to be a satisfactory solution, since the treatment of 4 sq m of the latter leads to only about 10 kg of residual ash. However, in putting such a process into operation there is a problem of transshipment of heterogeneous residues between the storage tank and the incinerator. The invention remedies those drawbacks, notably in eliminating the operations of mechanical pumping and filtration, difficult and complex. (Sinha-OEIS)
W81-01452

CHARACTERISTICS OF FULL AND PARTIAL MULTIPORT DIFFUSERS DISCHARGING THERMAL WASTES IN OPEN CHANNEL FLOW,
Florida Univ., Gainesville. Dept. of Civil Engineering.
B. A. Christensen, J. G. Melville, and A. D. Parr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-161085, Price codes: A08 in paper copy, A01 in microfiche. Florida Water Resources Research Center, University of Florida Publication No 49, December, 1980. 156 p, 52 Fig, 3 Tab, 36 Ref, 3 Append. OWRT-A-035-FLA(1), 14-34-0001-7019, 14-34-0001-7020.

Descriptors: *Heat transfer, *Diffusion, *Jets, *Open channel flow, *Thermal pollution, Discharge(Water), Pipe flow, Streamflow, Thermal water, Energy dissipation, Energy transfer, Hydraulics, Channel flow, Continuous flow, Heat flow, Temperature, Evaluation, Mechanical engineering, Equipment, Cooling towers, Waste water(Pollution).

Of the two system types which transfer condenser waste heat to the atmosphere, once-through cooling systems are significantly less costly than closed-cycle cooling systems. For once-through cooling, disposal methods using multiport diffuser-pipes provide the most efficient mixing by discharging the heated water effluent through high velocity jets near the bed of the receiving body of water. In addition, specific State of Florida regulations exist for heated effluent disposal in the Florida Administrative Code. The present work concerns itself with an undistorted physical model of a multiport diffuser-pipe, discharging heated water into a co-flowing ambient. Vertical jet angle and transverse discharge distribution were varied and the resulting mixing characteristics were noted. Best mixing for large distances downstream of the diffuser occurred with a jet angle of ten degrees, but major drawbacks existed. The most promising angle was 20 degrees. In port spacing, no jet interference was observed in the plan isotherms for any of the runs. Finally, it was observed that, for the same quantity of heat to be injected into the ambient, partial diffusers perform much less efficiently than full. The optimal design is to match the diffuser discharge distribution to that of the ambient. (Zielinski-IPA)
W81-01473

EFFECT OF SEWAGE EFFLUENT ON MICROBIAL ACTIVITIES AND COLIFORM POPULATIONS OF PAHOKEE MUCK,
Florida Univ., Belle Glade.
For primary bibliographic entry see Field 5B.
W81-01529

SOIL POTENTIAL RATINGS FOR SEPTIC TANK ABSORPTION FIELDS IN LEON COUNTY, FLORIDA,
Soil Conservation Service, Lanham, MD.
For primary bibliographic entry see Field 5B.
W81-01537

CODISPOSAL OF MUNICIPAL SOLID WASTE AND SLUDGE.
Public Works, Vol 111, No 2, p 88-89, 98, February, 1980. 3 Fig, 1 Tab, 1 Ref.

Descriptors: *Waste disposal, *Economics, *Sludge, *Municipal wastes, *Solid wastes, Incineration, Waste water treatment, Air pollution, Landfills, Leaching, Environmental effects, Boilers, Fuels, Energy conversion.

Simultaneous disposal of solid waste and waste water treatment sludges (codisposal) is proposed as a more efficient method of waste disposal and may be handled by landfilling, composting, or thermal destruction. Thermal destruction is useful for recovery of refuse derived fuel from multiple hearth or fluidized bed sludge incinerators, sludge in multiple solid waste (MSW) incinerators, sludge in MSW dedicated boilers, and sludge in MSW starved-air combustors. Of these, the MSW incinerator method proves the most economical. Comparisons of annual costs of the methods yielded estimated combined single purpose costs (in thousands of 1978 dollars) of 5,420 for the multiple hearth/fluidized-bed system, 6,395 for the water-wall method, 6,995 for dedicated boiler techniques, 1,077 for modular incineration and 8,495 for pyrolysis. EPA fundings for co-disposal options are also considered. The remaining questions concerning co-disposal technologies focus on environmental issues. Problems of air emissions and leachate from combustion residue matter landfills are the main ecological disadvantages of such systems. (Geiger-FRC)
W81-01634

5F. Water Treatment and Quality Alteration

PILOT STUDY OF FLUORIDE AND ARSENIC REMOVAL FROM POTABLE WATER,
Rubel and Hager, Inc., Tucson, AZ.
F. Rubel, Jr., and F. S. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-111080, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-100, August, 1980. 43 p, 5 Fig, 6 Tab, 8 Ref, 3 Append. 68-03-1351.

Descriptors: *Potable water, *Water purification, *Arsenic, *Fluorides, Adsorption, Water treatment, Pilot plants, Treatment facilities, Costs, Arizona, Activated alumina.

Fluoride and arsenic are two contaminants frequently found in high concentrations in drinking water. Occasionally, the two contaminants are found together in the same water supply, which presents a unique treatment problem. Pilot plant studies were conducted on the removal of fluoride and arsenic from potable water using activated alumina as the adsorbent. The tests were conducted using water from the community of Why, Arizona, that contained 3 mg/l fluoride and 0.15 mg/l arsenic. Activated alumina is shown to be effective means of treating this water. Arsenic is preferentially adsorbed on the activated alumina, and a stronger sodium hydroxide solution (4%) is required during regeneration of the activated alumina for arsenic than for fluoride (1%). The capacity of the alumina for removing fluoride is decreased by any arsenic remaining in the alumina. The pilot studies indicate that the preferred method of treating water with these combined contamiants is the use of two activated alumina columns in series. A schematic of a full-sized treatment plant is included, along with engineering estimates of operating and capital equipment costs for small communities. Operating costs are approximately 5 cents per kiloliter of treated water (19 cents per 1000 gallons). (Moore-SRC)
W81-01437

PACKAGE WATER TREATMENT PLANTS, VOLUME 1. A PERFORMANCE EVALUATION,
Cincinnati Univ., OH. Dept. of Civil and Environmental Engineering.
J. M. Morand, C. R. Cobb, R. M. Clark, and R. G. Stevie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-110934, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-008a, July, 1980. 54 p, 10 Fig, 13 Tab, 8 Ref, 2 Append. GS-05S-10458.

Descriptors: *Water treatment, *Treatment facilities, *Potable water, *Rural areas, Kentucky, West Virginia, Tennessee, Costs, Turbidity, Water quality, Water purification, Operation and maintenance.

Many small and rural water systems have both cost and quality problems. Their unit costs tend to be higher because of the small number of connections they service. Package water treatment plants are a possible alternative to conventional water treatment. These plants are self contained units that can be installed for minimum cost. Results from a study of 36 package plants in Kentucky, West Virginia and Tennessee show that these treatment plants can provide water that meets the turbidity limits established under the National Interim Primary Drinking Water Standards. Plants that were not meeting standards had problems caused by lack of operator attention, such as not varying chemical dosage to meet changing raw water quality, or they were not running for lengths of time sufficient to achieve stable operation. These plants, contrary to some manufacturers' claims, are not totally automatic but require supervision. Nevertheless when properly maintained and operated, they can provide good quality drinking water at minimum cost. (Moore-SRC)

W81-01440

SPLIT FLOW WATER TREATMENT PLANT,
Neptune Microfloc, Inc., Corvallis, OR. (Assignee).
A. K. Hsiung, and G. F. Eaton.
U. S. Patent No 4,199,451, 5 p, 4 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 4, p 1372, April 22, 1980.

Descriptors: *Patents, *Water treatment, *Waste water treatment, Water purification, Flow control, Settling basins, Flocculation, Filtration, Water levels, Equipment.

It is an object of this invention to provide a packaged water treatment plant that will permit more cost-effective design configurations, provide treated water in larger capacities, and which will be applicable to both water and waste water treatment. The split flow water treatment plant includes a settling basin comprising a pair of banks of generally horizontally extending settling tubes and an inlet baffle comprising parallel vertical perforated sheets upstream of and adjacent to each of the banks. An inclined diverting plate extends from the downstream end of the lowermost tube in the first of the banks to the upper upstream end of the inlet baffle adjacent the second bank. The distribution of flow between the banks may be regulated by an adjustable weir or by water level control. (Sinha-OEIS)
W81-01445

FILTER APPARATUS USING FLOATING FILTER MEDIUM,
Ishigaki Kiko Co. Ltd., Tokyo (Japan). (Assignee).
A. Iwatani.
U. S. Patent No 4,198,301, 9 p, 4 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 986-987, April 15, 1980.

Descriptors: *Patents, *Water treatment, *Water quality control, Filtration, Separation techniques, *Filters, Equipment, Backwashing, Floating filter medium.

A filter apparatus contains a filter tank separated by a water-penetrable partition wall into an upper section forming a filtrate reservoir and a lower section forming a filter chamber. Floating filter medium is place in the filter chamber. Water to be filtered is fed into the filter chamber at the bottom and caused to flow upward, passing through the floating filter medium. The filtrate is removed from the reservoir. The apparatus is further characterized by the improvements including: apparatus for agitating the filter medium, a pit beneath the filter chamber, a siphon-shaped discharge pipe for back-flow wash water with a discharge opening positioned adjacent the bottom of the pit, the discharge pipe being provided with a siphon breaker having an air feed port positioned adjacent the bottom of the filter chamber, a supply pipe for feeding water to be filtered into the filter chamber with a feed opening positioned adjacent the bottom of the filter chamber so as not to disturb water retained in the pit. (Sinha-OEIS)
W81-01453

PROCESS AND APPARATUS FOR TREATING DRINKING WATER,
Consolidated Foods Corp., Old Greenwich, CT. (Assignee).
J. J. Doumas, A. H. Molof, G. H. Raymond, and L. Wikstrom.
U.S. Patent No 4,198,296, 14 p, 11 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 3, p 984, April 15, 1980.

Descriptors: *Patents, *Water treatment, *Water quality control, *Water purification, Suspended solids, Halides, Activated carbon, Oxidation, Disinfection, *Silver ions.

A process and apparatus for producing biologically safe and palatable drinking water is described in which water may be preconditioned by removal of suspended solids and further subjected to removal of halide ions and then subjected to treatment with a disinfectant or combination of disinfectants capable of exercising suitable biocidal and virucidal action. This may be followed by steps and the utilization of apparatus to reduce below the legal limit for potable water the disinfectant. The disinfectant may be supplied by a compound capable of releasing silver ions by contacting the water with a media of activated charcoal having absorbed silver salts. Oxidizing disinfectants may be applied as solutions or soluble solids either alone or in sequence with silver ions. Objectionable amounts of the disinfectant may be reduced to the amount below the legal limit for potable water by passing the treated water through an activated charcoal media which is sanitized against bacterial growth or through ion exchange resins similarly sanitized or through a combination of both. The invention involves use of silver ions in the absence of chloride as a purifying agent. The use as purifying agents of other metallic ions, such as mercury ions or oxidizing disinfectants is also facilitated by the prior elimination of halide ions. (Sinha-OEIS)
W81-01458

WATER QUALITY EFFECTS RELATED TO BLENDING WATERS IN DISTRIBUTION SYSTEMS,
Southern California Metropolitan Water District, Los Angeles.
W. K. Schimpff, and H. E. Pearson.
Environmental Protection Agency Report EPA-600/2-80-132, August, 1980. 106 p, 25 Fig, 15 Tab, 15 Ref, 1 Append. R804709.

Descriptors: *Water distribution(Applied), *Water quality, *Imported water, *Corrosion, *Water chemistry, California, Diurnal, Corrosion control, Groundwater, Hardness(Water), Water properties, Alkalinity, Hydrogen ion concentration, Calcium carbonate, Water supply, Zinc phosphate, *Water blending effects.

In an area with a regional supplemental water supply there is the chance that a given water distribution system may be exposed to two waters of different quality and origin, and to various blends of the two waters, which could have an adverse effect on the distribution system itself or on the quality of the water. The Environmental Protection Agency mobile water quality monitoring laboratory was deployed at 30 selected sites in southern California where imported waters from the Colorado River and California aqueducts are used as delivered or blended with local groundwaters. Eighteen computer controlled parametric systems on board the laboratory analyzed and recorded field data to assess water quality factors associated with corrosion and stability. The waters studied could be classified as having moderate to high hardness, alkalinity and total dissolved solids content. The data were analyzed for significant interrelationships relative to pH, calcium hardness, alkalinity, dissolved minerals, corrosion rates, calcium carbonate deposition test results, and calculated values for the Langelier saturation and Ryzner stability indices. For waters of similar chemical composition the calcium carbonate deposition test results were more indicative of the benefits to be derived from pH control or zinc phosphate films for mitigating corrosion than the polarization corrosion rates. In one case, the diurnal shifting from one water source to another resulted in higher corrosion rates during the period when the surface water was blended with the well water than when either water was delivered alone. On the basis of this study, the blending of imported surface waters and their mixing with local groundwaters in this regional water system has not generated serious water quality problems in the distribution systems of the area. (Moore-SRC)
W81-01484

DECLINING-RATE VERSUS CONSTANT-RATE FILTRATION,
Sao Paulo Univ. (Brazil). Dept. of Hydrology and Sanitation.
For primary bibliographic entry see Field 5D.
W81-01532

AN OVERVIEW OF EUROPEAN WATER TREATMENT PRACTICE,
Water Storage Corp., Rotterdam (Netherlands).
P. L. Knoppert, G. Oskam, and E. G. H. Vreedenburgh.
Journal of the American Water Works Association, Vol 72, No 11, Part 1, p 592-599, November, 1980. 9 Fig, 17 Tab.

Descriptors: *Water treatment, *Water pollution treatment, *Storage, *Europe, Water quality control, Water purification, Organic chemicals, Ammonia, Chlorination, Rivers, Ozone, Monitoring, Bioindicators, Coagulation, Rhine River, Activated carbon.

Although European river water quality has improved with respect to certain parameters, the micropollutant load is still a major problem. This paper discusses recent water technology developments in several European countries. Automatic monitoring continuously measures water quality in major rivers. Several countries use the behavior of live rainbow trout to warn of high pollution levels, especially an accidental release of toxic material. Emergency storage protects against accidental pollution situations and during periods of low flow. Storage also decreases the concentration of ammonia, heavy metals, bacteria, organic chemicals, and other contaminants. Chlorination of raw water before transport has been largely eliminated to reduce production of trihalomethanes. Biological nitrification is used to oxidize ammonia in place of breakpont chlorination. Some cities now use chlorine dioxide or ozone in place of chlorine. Reducing precursor levels is accomplished by using improved coagulants (alkaline polyaluminum chloride), optimized floc separation techniques, and granular or powdered activated carbon. (Cassar-FRC)
W81-01533

CANCER MORTALITY AND PUBLIC DRINKING WATER IN ST. LOUIS CITY AND COUNTY,
Missouri Univ.- Columbia.
C. J. Marienfeld, M. D. Collins, H. T. Wright, R. Reddy, and G. Shoop.
Journal of the American Water Works Association, Vol 72, No 11, Part 1, p 649-654, November, 1980. 5 Tab, 14 Ref.

Descriptors: *Potable water, *Mortality, Epidemiology, Public health, *Cancer, St. Louis, *Water pollution effects, Pathology, Human diseases.

Cancer death certificates for St. Louis City and County were classified according to residential areas served by the different water sources identified: the Missouri River, the Meramec River, and a deep well. The latter two sources were hypothesized to have lower carcinogen contents than the Missouri River water. However, the higher cancer death rate in the city of St. Louis as compared with the adjacent St. Louis County was concluded not to be a result of differences in the city and county water supplies for the period of study, 1960-1976. In fact, no significant differences in water quality are seen in the common source, the Missouri River, in the treatment processes, in Ames mutagenicity tests, nor in inorganic chemical analyses. The mortality rates appear to be inversely correlated with income and school years completed, and directly correlated with the percentage of incomes below the poverty level, percentage of unskilled workers, and air pollution as measured by suspended particulates and sulfur dioxide. (Cassar-FRC)
W81-01534

ELEVATED LEVELS OF SODIUM IN COMMUNITY DRINKING WATER,
Massachusetts Univ., Amherst.
E. J. Calabrese, R. W. Tuthill, J. M. Klar, and T. L. Sieger.
Journal of the American Water Works Association, Vol 72, No 11, Part 1, p 645-649, November, 1980. 2 Fig, 1 Tab, 21 Ref.

Descriptors: *Sodium compounds, *Potable water, *Blood pressure, Hypertension, Water pollution effects, *Massachusetts, Standards, Human diseases, Salinity, Water properties.

Students in two geographically contiguous Massachusetts towns with similar socio-economic conditions and differing sodium levels in the drinking water were subjects of a blood pressure study. Both third grade and tenth grade students in the community with higher sodium content (107 mg per liter) in the water supply had statistically significantly higher blood pressures than those children from the low sodium area (8 mg per liter). Systolic and diastolic readings differed by about 3-5 mm Hg between the two communities. Excretion studies on the third graders showed Na-K ratios of 5.4 (boys) and 5.1 (girls) for those drinking high sodium water and 3.7 for those in the low sodium area. (Cassar-FRC)
W81-01535

RESOURCE MANAGEMENT OF AN INDUSTRIAL RIVER SYSTEM,
Yorkshire Water Authority (England).
K. H. Tattersall.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 5, p 453-473, 1980. 4 Fig, 3 Tab.

Descriptors: *Management, *River systems, *Reviews, Riparian rights, Sewage treatment, Rivers, Water quality, Legal aspects, Water resources, Resource allocation, Geology, Topography, Flow rates, River basin development, Industrial wastes, Industrial water, *Yorkshire River System(UK), *England.

Management of an industrial river may call for its proper use as a drainage channel, a source of water power, or a hydro-cooling device. In Great Britain the Water Resources Act of 1963 and the Control of Pollution Act of 1974 are aids in water resource management in controlling the use of industrial rivers. The Yorkshire River system is examined as typical industrial river, and its management by the Yorkshire Water Authority is reviewed. The topography, geology, and tributaries of the system as well as the populations that they serve are outlined. Among the hydrologic considerations of an industrial river, the dry weather flow is an important management parameter. Flow diagrams are used to estimate flow information at various points along the river. River water quality models are usually calculated for each pollutant to aid in the management of the industrial river. The Water Resources Act set guidelines for compensation water to meet modern requirements. Other aspects of industrial rivers that are examined include water power, fish farming, irrigation, industrial and groundwater abstractions, mine drainage, sewage treatment, and trade effluents. The Water Authority is responsible for managing a river to satisfy the greatest number of interests and preserve riparian rights. (Geiger-FRC)
W81-01542

THE OCCURRENCE OF MICROORGANISMS IN WATER MAIN ENCRUSTATIONS,
Environmental Protection Agency, Dallas, TX. Air and Hazardous Materials Div.
For primary bibliographic entry see Field 5B.
W81-01545

BACTERIAL, CHEMICAL, AND MINERALOGICAL CHARACTERISTICS OF TUBERCLES IN DISTRIBUTION PIPELINES,
Ohio State Univ., Columbus. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W81-01546

UPGRADING THE OLD WHILE BUILDING THE NEW,
Inca, Ltda, Cali (Colombia).
L. E. Medina, and H. E. Hudson, Jr.
Journal of the American Water Works Association, Vol 72, No 12, p 666-671, December, 1980. 4 Fig, 5 Ref.

Descriptors: *Water treatment, *Construction, Water quality control, Construction costs, Costs, Planning, *Colombia, Water demand, Potable water, Deforestation, Turbidity, On-site investigations, Low flow, Flocculation.

The upgrading of an already existing water treatment plant during the construction of a new facility to meet increased consumer demand is reviewed. The Rio Cali plant was 50 yrs old. The renovation undertaken allowed its capacity to be increased and advantage taken of the low turbidity of the Rio Cali throughout most of the year. An additional advantage is that the plant serves the higher, older part of the city by gravity, thus reducing energy costs. The study included a determination of the hydraulic capacity of the system, a study of the processing capacity of existing structures, and the design of modifications to yield increased capacity. The maximum capacity of the raw water canal was determined to be set for 173 ML/day. The flocculation, sedimentation, and filtration systems are described. The modification was undertaken in a series of steps, since the service could not be interrupted. (Baker-FRC)
W81-01547

HYDRAULIC CONSIDERATIONS IN DECLINING-RATE FILTRATION,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 5D.
W81-01550

NEW DAY DAWNS FOR CALIFORNIA WATER,
T. S. Maddock, and D. L. Hardan.
Water and Wastes Engineering, Vol 17, No 10, p 39-42, October, 1980. 1 Fig, 3 Tab.

Descriptors: Networks, *Treatment facilities, *Municipal water, Industrial water, *California, Flocculation, Filtration, Chlorination, Chemicals, *Irrigation water, Agriculture, Telemetry, *Domestic water, Quartz Hill treatment plant(CA).

The Quartz Hill water treatment plant, which will provide full treatment for 14 mgd of raw water and will eventually expand to treat 56 mgd, is described as the major facility in the DAWN (Domestic and Agricultural Water Network) water distribution system. DAWN will distribute 140,000 acre-feet of water annually for municipal and industrial use through a 150 mile distribution network. The Quartz Hill water treatment plant is the administrative headquarters of DAWN and houses the project management and operational facilities, including the central computer. Influent first passes through a moss screen, then water is treated as needed with chemicals: chlorine, alum, polyelectrolytes, caustic soda, and activated carbon. Following mixing with chemicals, flocculation is performed. Water is clarified and passed through four dual media filters. After chlorination, the water is released to the distribution system. Sludge is dewatered and transported to a Class 2 disposal area. (Small-FRC)
W81-01576

NEW YORK CITY'S PILOT PLANT FILTER STUDIES,
Metcalf and Eddy, Inc., New York.
G. P. Fulton.
Public Works, Vol 111, No 4, p 62-64, April, 1980. 3 Fig.

Descriptors: *Pre-treatment, *Pilot plants, *Filters, *Water treatment, Model studies, Turbidity, Color, Organoleptic properties, Water quality, Filtration, Sludge, Flocculation, Porous media, Costs, *New York City.

The high costs of water treatment, resulting in part from the stringent regulations of the Federal Safe Drinking Water Act, have led to a number of pilot plant studies aimed at upgrading the water quality of the Croton System, a 375 square mile major watershed of the New York City area. In the spring of 1971, the Croton supply was plagued with unsatisfactory organoleptic features attributed to an increased nutrient load from excessive urban development, and consequently better water treatment methods were sought. Various piping arrangements in pilot plant studies allowed the use of all, some, or none of four pretreatment chambers which offered flocculation, settling or filtration. Filtration options involved the use of dual anthracite/sand media or Neptune Microfloc multimedia. The flow rate through each pretreatment pattern was kept at 10 gpm, and turbidity was continuously recorded from inlet raw water, filter manifold water, and filter effluents. Piezometric measurements were made manually by manometer for each filter. After 14 months of testing, no distinct prototype simulations were obtained from the settling experiments due to unpredictable sludge depths. The granular filter performed well in the pilot simulation, but care must be taken during filter washings to eliminate trapped air surges. The release of dissolved air near filter heads due to changes in water temperature must also be carefully monitored by the operator. It was also noted that full-sized filter units cannot be effectively simulated in pilot column installations, and care must be taken in selecting a single spray nozzle with a proper discharge pattern. Some energy and costs considerations for the pilot pretreatment systems are also given. (Geiger-FRC)
W81-01642

ECONOMICAL ZERO DISCHARGE ACHIEVED AT WATER PLANT,
Wauford (J. R.) and Co., Nashville, TN.
R. C. Woods.
Public Works, Vol 112, No 1, p 65, January, 1981.

Descriptors: *Water treatment, *Treatment facilities, *Settling basins, *Water purification, Potable water, Sludge disposal, Lime, Chemicals, Project post-evaluation, Tennessee, Costs, Lewisburg(TN).

The city of Lewisburg, Tennessee, acting as its own general contractor, built a 4 mgd water treatment plant with no waste water discharge for $172,000. The treatment facility consists of a large reinforced settling tank with a total water volume of 250,000 gal. This tank functions as a gravity thickener, with dual rectangular hoppers for sludge withdrawal and a telescoping valve for decanting supernatant. The thickened sludge is dewatered on open-air sand drying beds, and final disposal is on city owned property by trench burial. Treatment chemicals are alum, lime, and occasionally potassium permanganate and activated carbon. Thus the sludge is basically an alum-lime sludge. The supernatant is recycled, making zero discharge of waste water possible. Thus, no waste water is discharged back into the Duck River. Through proper management, the city was able to build a very successful plant itself. (Small-FRC)
W81-01643

5G. Water Quality Control

INVESTIGATION INTO EFFLUENT DISCHARGES FROM WASHINGTON FRESH APPLE PACKERS, VOLUMES I AND II,
SCS Engineers, Long Beach, CA.
For primary bibliographic entry see Field 5B.
W81-01431

COALESCENCE OF OIL IN OIL/WATER EMULSIONS,
Imperial Chemical Industries Ltd., London (England). (Assignee).
D. B. Chambers, and B. Walker.
U. S. Patent No 4,199,447, 4 p, 6 Ref; Official Gazette of the United States Patent Office, Vol 993, No 4, p 1371, April 22, 1980.

Descriptors: *Patents, *Water quality control, *Oil pollution, *Water pollution treatment, Emulsions, Coalescence, Plastics, Separation techniques, Oleophilic properties.

This invention related to a method for the removal of oil from an oil in water emulsion by passing the emulsion through a fibrous structure comprising fibres having finely divided particles having an average size of one micron or less and which exhibit oleophilic and hydrophobic properties adhered to and penetrating their outer surfaces, and removing the coalesced oil droplets so formed. A particularly desirable expanded plastics material for this purpose is a hydrophilic plastics material

such as a hydrophilic polyurethane foam. (Sinha-OEIS)
W81-01446

OIL/WATER SEPARATION PROCESS AND APPARATUS,
Imperial Chemical Industries Ltd., London (England). (Assignee).
G. F. G. Clough.
U.S. Patent No 4,199,446, 6 p, 2 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 993, No 4, p 1371, April 22, 1980.

Descriptors: *Patents, *Water quality control, *Water pollution treatment, *Oil pollution, Emulsions, Coalescence, Equipment, Flow control, Separation techniques, Gravity separation.

Oil is removed from an oil in water emulsion by a process in which the emulsion is passed through a coalescer which coalesces the oil droplets within the emulsion so that they can be removed by gravity separation. The emulsion is passed into and through a vessel containing a rectangular shaped oil coalescer which is immersed in the emulsion so that the emulsion flows through the coalescer from a first face to a second face. During operations suspended solids are retained on the upstream face of the coalescer and the passageways through the coalescer are progressively obstructed by the solids. Changing the position of the coalescer within the vessel and reversing the direction which the emulsion flows through the coalescer allows the emulsion to flow through the coalescer from its second face to the first face. The temporary reversal of flow through the coalescer causes a substantial proportion of the retained solids to be dislodged and removed in the stream. (Sinha-OEIS)
W81-01447

WATER QUALITY MANAGEMENT-HAVE WE LOST SIGHT OF THE OBJECTIVE,
Mathematical Sciences Northwest, Inc., Bellevue, WA. Consulting Div.
For primary bibliographic entry see Field 6E.
W81-01510

AN OVERVIEW OF EUROPEAN WATER TREATMENT PRACTICE,
Water Storage Corp., Rotterdam (Netherlands).
For primary bibliographic entry see Field 5F.
W81-01533

STATISTICS FOR GROUNDWATER QUALITY ASSESSMENT,
Calscience Research, Inc., Huntington Beach, CA.
R. D. Morrison, and R. J. Stearns.
Public Works, Vol 111, No 2, p 90, 100, February, 1980. 2 Tab.

Descriptors: *Statistical models, Water quality, *Water quality control, Monitoring, *Groundwater, Leaching, Landfills, Waste disposal, Wells, Probability, Water pollution sources, Mathematical studies, Equations.

As groundwater quality monitoring programs expand, the maintenance of an overall perspective becomes more difficult. Often officials must rely on data obtained from the sampling of well networks to monitor the quality of an underground water supply. This system is useful in checking for contaminating leachates from waste disposal sites when complete physiographic baseline data is available. Statistical models are described to aid in reducing judgmental errors in monitoring practices. Sampling wells must be categorized in terms of their relationship to the contamination source. The categorization system distinguishes a background well, an onsite well, a downstream well, and an underlying well. The parametric r, Student's t test, and the Mann-Whitney U test provide a wide range of statistical accuracy. An equation is given to generate probability values (P). Low P values (less than .05) are suggestive of a relationship between two well groups, while P values greater than .05 indicate a lower probability of a relationship between well groups. The system provides useful data about the relationship of a disposal site to observed groundwater quality degradation. (Geiger-FRC)
W81-01635

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

AN EVALUATION OF MICHIGAN'S WETLAND PROTECTION ACT AND RECOMMENDATIONS FOR ITS IMPLEMENTATION,
Great Lakes Basin Commission, Ann Arbor, MI.
R. A. Sullivan, and C. Wyman.
Great Lakes Environmental Planning Study (GLEPS), Contribution No 27. August, 1980. 171 p, 16 Fig, 3 Tab, 3 Append.

Descriptors: *Michigan, *Wetlands, *Coastal marshes, *Water values, *Management, Flood protection, Aquatic habitats, Wildlife habitats, Groundwater recharge, Project planning, Project benefits, Bogs, Swamps, Marshes.

The Goemaere-Anderson Wetland Protection Act of 1980 is the result of a long-term effort to provide Michigan's wetlands with comprehensive and meaningful protection. The key provisions of the act are presented and analyzed. To make the act most effective, it is necessary to identify the major questions and problems most likely to arise in implementing it. A number of issues should be addressed by the Department of Natural Resources (DNR), including delineation of regulated wetlands, further clarification of certain Section 9 standards for permit review, determining an effective date for 'grandfathered' status to be assigned to a project, administration of a general permitting system, and means to deal with upland uses directly impacting wetlands. The DNR should initiate an active information/education effort to familiarize the public with the requirements and benefits of the act; in the process, DNR may learn of some non-regulated wetlands. Monitoring and enforcement should be a key part of the protection program. Procedures should be developed to define wetlands and to evaluate and estimate project impacts. A continuous evaluation of the program from its inception should be instituted; such an evaluation could save money and increase wetlands protection. Michigan's fiscal troubles underscore the necessity of carefully evaluating different program elements for their contribution to the ultimate program goals. (Atkins-Omniplan)
W81-01435

FLOOD CONTROL OPERATIONS AND OPTIMIZATION: A CASE STUDY FOR BONNY RESERVOIR, COLORADO,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. Kimzey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-163586, Price codes: A09 in paper copy, A01 in microfiche. MS Thesis, Summer, 1980. 179 p, 76 Fig, 20 Tab, 36 Ref, 7 Append. OWRT-B-195-COLO(2).

Descriptors: Reservoirs, *Flood control, *Flood routing, Operation optimization, *Optimization, Simulation analysis, Storm runoff, Hydrographs, Forecasting, Bonny Reservoir, South Fork Republican River(CO), Colorado.

Flood control operations for reservoirs are evaluated by discussing existing policies and optimization and simulation techniques. A case study for Bonny Reservoir, Colorado, routes five generated storm hydrographs through the reservoir considering the influence of the downstream reservoir. The storms are routed by a computer algorithm which simulates the standard operating rule and by a dynamic programming optimization algorithm. The resulting releases were lower for the more extreme storm events and higher for the less extreme storm events with the dynamic programming algorithm than the simulated standard operating rule.
W81-01494

PLANNING GROUNDWATER SUPPLY SYSTEMS FOR URBAN GROWTH: A MULTILEVEL PERSPECTIVE,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
J. W. Delleur, S. A. Dendrou, and G. V. Loganathan.
In: Water and Related Land Resource Systems. International Federation of Automatic Control Symposium, Cleveland, Ohio, 28-31 May, 1980, p 239-249, 1980. 6 Fig, 7 Tab, 17 Ref. Pergamon Press, New York. OWRT A-057-IND(2) and B-083-IND(12).

Descriptors: *Groundwater, *Urban water supply, Finite elements, Large scale systems, Mixed integer programming, Optimization, Urban systems, Water resources, Planning, Water supply, Urbanization, *Groundwater supply, *Model studies, Costs, Indiana, West Lafayette(IN).

A methodology has been developed to include effectively water supply from groundwater in urban planning. The model LANDUSE for prediction of urban development and water demand is linked to the model WATSUP, an optimization oriented finite element based water supply model for prediction and optimization of future water supply configurations. The nonlinearity of the objective function due to nonlinear head losses has been circumvented by means of empirical relationships for head losses and design criteria for pump and pipe sizes. The requirement that some decision variables such as the number of wells, equalizing reservoirs, etc. be integer variables leads to a mixed integer programming formulation. A two level coordination scheme is used in locating an optimal number of facilities such that cost is minimized and a safe exploitation of aquifer in the future is guaranteed. The methodology is applied to an actual situation in West Lafayette, Indiana.
W81-01498

PRACTICAL ASPECTS OF TOWN WATER PLANNING,
P. G. Fischer, Jr., and T. T. Chiang.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 159-172, March, 1980. 7 Fig.

Descriptors: *Planning, *Computer models, *Water demand, Model studies, Mathematical models, Runoff, Water requirements, River basin development, Watersheds, *Water supply, Precipitation, Rainfall disposition, Costs, Diversion, Water management, Probability, Ipswich River Basin, *Municipal water.

A case study was made of the practical aspects of town water-supply planning to demonstrate the importance of probability distributions of estimated demands and rainfall and to explain the use of digital computer modeling as a method for analyzing these probability distributions. The involvement of the 'systems' aspects along the reach of the river, including legal constraints, was also demonstrated. The Ipswich River Basin served as the study site, and the precipitation, population, projections, and water demand projections of this area are outlined. A 'safe yield' and a drought yield approach are examined for precipitation design purposes. Results have shown that the Nicholas Brook area would provide a divertable flow when combined with the existing impoundment storage, while the new 1.3 billion gallon Emerson Pond Reservoir would add 9.0 mgd. Raising the pool elevation of Swan and Middletown Ponds would create a 'safe yield' of 10.0 mgd. A data base for runoff data gave a detailed analysis of projected quantities and diversion rates, while knowledge of the precipitation probability allowed power costs to be developed. Energy and equipment costs and legal and topographical constraints are also examined. (Geiger-FRC)
W81-01511

COMMENT ON 'STOCHASTIC OPTIMIZATION OF WATER SUPPLY EXPANSION' BY M.G.V. BOGLE AND M. J. O'SULLIVAN,
Army Engineer Waterways Experimental Station,

Vicksburg, MS.
T. M. Walski.
Water Resources Research, Vol 16, No 6, p 1138, December, 1980.

Descriptors: *Estimated costs, *Water supply, *Construction costs, Planning, Water distribution(Applied), Public utilities, Cost analysis, Economics, Diseconomies of scale, Unit costs, Project planning.

The author suggests that the Bogle and O'Sullivan method (1979) for scheduling water supply plant expansion may have no practical application. Basically, the method describes construction of a water plant with annual incremental capital expenditures rather than expansions in 10 to 30 year increments. O'Sullivan and Bogle answer that their method applied to a particular type of plant capacity expansion problem which occurs in some water supply systems. The work was motivated by a proposed plant for Auckland, New Zealand. (Cassar-FRC)
W81-01513

A MODEL FOR LAND USE AND WATER QUALITY,
Washington Univ., Seattle. Graduate School of Public Affairs.
L. D. Goodisman, and F. Caslich.
Water Supply and Management, Vol 4, No 5/6, p 371-377, 1980. 6 Fig, 6 Ref.

Descriptors: *Water quality, *Land use, *Model studies, Planning, Washington, River basins, Water pollution sources, Municipal wastes.

A model for the relationship between land use and water quality was developed and tested to provide data on pollution from non-point sources. This information may be used for planning purposes and to set priorities for pollution abatement. It specifies a chain of relationships between land ownership (forest or park service, Indian, state, private) and hydromodifications (reservoir, channel, agricultural), between water parameters and water quality, between water quality and land use (agriculture, urban, range, forest), and between hydromodifications and river basin properties. As applied to river basins of the State of Washington, the model predicted 88% of the variation in biological water quality and 96% of the variation in recreational water quality. (Cassar-FRC)
W81-01571

CO-ORDINATION OF MODELS IN SOFTWARE SYSTEMS FOR LARGE SCALE WATER RESOURCES PROJECTS,
Soyuzgiprovodkhoz, Moscow (USSR).
A. S. Berezner, and F. I. Ereshko.
Water Supply and Management, Vol 4, No 4, p 253-262, 1980. 9 Ref.

Descriptors: *Mathematical models, *Water resources development, Model studies, Data processing, Stochastic processes, Computer models, Agriculture, Hydroelectric power, Water resources, Simulation analysis, Water supply development, Watershed management, River basin development, Water utilization, Recreation facilities, Design criteria.

Procedures are suggested for carrying out experiments on simulation systems for developing river basins using optimization and game-theoretic models. The system combines research from mathematicians, design engineers, agronomists, ichthyologists and other specialists under a process of computerized information management. Emphasis is placed on the development of scenarios to define control and stochastic parameters within the system of models. The generation of a water supply system scenario is described in detail. The simulation system for examining river basins used the following block models: water resources, agriculture, hydro-electric power, development of industry and of communal services, fishing, river transportation, and the sea. The interrelations of the water resources block, the agricultural block and the hydro-electric block are explained mathematically. The roles of sub-blocks of the agricultural block (the animal husbandry and plant sub-blocks) in the model are also explored. (Geiger-FRC)
W81-01573

6B. Evaluation Process

RESEARCH NEEDS IN MODELING AND DATA INTERACTIONS AS RELATED TO GOVERNMENT WATER RESOURCES PROGRAMS,
D. R. Dawdy, and T. Maddock, III.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-161002, Price codes: A04 in paper copy, A01 in microfiche. Completion Report to Office of Water Research and Technology, October, 1980. 50 p, 1 Tab, 28 Ref. OWRT-C-90293-T(No 9629)(1), 14-34-0001-9629.

Descriptors: *Research priorities, *Model studies, *Data collections, *Water resources, *Federal project policy, Federal government, Institutions, Management, Research and development, Evaluation, Planning, Project planning, Testing, Design, Experimental models, Mathematical models, Estimating, Hydrologic data, Theoretical analysis, Governmental interactions, Networks.

Four research areas were examined as they relate to three topics, groundwater, surface water, and, to a minor extent, water quality; since the problems and models for each of the three topics raise different questions. The research areas examined were: (1) assessment of problems facing water resources managers; (2) describing how models fit into programs developed to solve water resources problems; (3) assessing how well models fit program objectives; and (4) assessing data requirements for the models in terms of the way data requirements, models, and programs interact. About 40 questions were developed and categorized in the assessment of models, data needs, and government programs that use these models and data, to identify research needs. It was also generally concluded that: a central clearinghouse is needed concerning model use to judge the use and appropriateness of models; research should be undertaken into attitudes toward modeling; the worth of existing data and situations of no data should be evaluated as related to modeling; and that model uncertainty analysis should be applied more widely and consider economic impacts for model requirements that generate data requirements. (Zielinski-IPA)
W81-01429

PRELIMINARY ANALYSIS OF HYDROPOWER PRODUCTION FEASIBILITY AT TWENTY-ONE EXISTING DAM SITES IN THE STATE OF MINNESOTA,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
J. Gulliver, R. J. Garver, R. E. A. Arndt, and C. E. Bowers.
Project Report No 196 prepared for State of Minnesota Energy Agency, August, 1980. 25 p, 5 Fig, 5 Tab, 9 Ref.

Descriptors: *Minnesota, *Hydroelectric plants, *Damsites, *Feasibility studies, Power head, Hydraulics, Hydrologic data, Discharge(Water), Inflow, Flow rates, Rehabilitation, Economic feasibility, Cost repayment, *Hydropower production feasibility.

A preliminary estimate of hydropower production feasibility was made for twenty-one existing dam sites in the State of Minnesota. The purpose of the preliminary analysis was to determine whether a comprehensive feasibility study is justified for the site. The expected annual energy production and initial project cost were estimated for each site. Initial cost estimates include turbine, generator, transmission line, and other electromechanical features as well as the civil features of hydropower retrofitting. Initial cost does not include dam rehabilitation, since the required information is not available for 19 of the 21 sites. The 'relative cost' of the project was defined as the initial cost divided by the annual energy production, and was calculated for each site. The relative cost and general curves for payback period were used to estimate hydropower feasibility at each site. The results of the preliminary analysis are: 5 sites have good or very good hydropower feasibility, 6 sites are marginal, and 10 sites have poor hydropower feasibility. Estimates of the cost of a comprehensive feasibility study are included for each site. (Author's abstract)
W81-01430

AN EVALUATION OF MICHIGAN'S WETLAND PROTECTION ACT AND RECOMMENDATIONS FOR ITS IMPLEMENTATION,
Great Lakes Basin Commission, Ann Arbor, MI.
For primary bibliographic entry see Field 6A.
W81-01435

MEASURING BENEFITS AND THE ECONOMIC VALUE OF WATER IN RECREATION ON HIGH COUNTRY RESERVOIRS,
Colorado State Univ., Fort Collins. Dept. of Economics.
R. G. Walsh, R. Aukerman, and R. Milton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-161044, Price codes: A04 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University Competion Report No 102, September, 1980. 50 p, 5 Fig, 13 Tab, 46 Ref. OWRT-B-175-COLO(1), 14-34-0001-8068.

Descriptors: *Recreation demand, *Economics, Water demand, Recreation facilities, *Reservoirs, Public land, Social aspects, High mountain reservoirs, Public benefits, Evaluation, Front Range(CO), *Colorado.

This report analyzed the public benefits from expanding recreation opportunities at high mountain reservoirs located in the Front Range of Colorado. Until recently, more than 100 reservoirs with 3,500 surface acres were closed to public use, representing 40% of the total surface area of reservoirs at 6,000 to 11,000 feet elevation. A representative sample of 200 persons were interviewed at 14 study sites. Respondents reported willingness to pay contingent on changes in congestion and water level. Benefit functions were adjusted for the effects of crowding, reservoir water drawdown, characteristics of participants, type of recreation facilities present, and costs of management. Policy implications were discussed with emphasis on application of the information to water management decisions. Benefits from expanding recreation opportunities at high mountain reservoirs which until recently were closed, would accrue to all individuals who have access to high mountain reservoirs, because of the reduced congestion which would result at substitute sites. Providing access to one-third more undeveloped and semi-developed reservoirs would increase individual recreation benefits by an average of $3-$6 per user day. However, the same cannot be said for fully developed reservoirs, where expansion of recreation opportunites is not critical in the short run.
W81-01468

QUALITATIVE ASSESSMENT OF THE ECONOMIC IMPACTS OF A RISING WATER TABLE, LAS VEGAS, NEVADA,
Nevada Univ. System, Reno. Water Resources Center.
W. W. Woessner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-161051, Price codes: A03 in paper copy, A01 in microfiche. Publication No 41068, 1980. 24 p, 7 Fig, 2 Tab, 13 Ref, Append. OWRT-A-091-NEV(1), 14-34-0001-9030.

Descriptors: *Water table, *Groundwater management, *Groundwater movement, *Economic impact, *Irrigation effects, Water injury, Salinity, Infiltration, Lawns, Nevada, Las Vegas Valley(NV).

This effort was directed toward reviewing available information on the shallow groundwater reservoir in Las Vegas Valley and assessing the general

existing and potential economic consequences resulting from evidence of a rising shallow water table. The rising water table is principally a result of excessive lawn irrigation. Over 50% of the valley is within an area in which the water table is less than 50 feet below land surface. Groundwater infiltration and inflow to sewer lines which result in excessive high salinity water for treatment are the current and most immediate future economic impacts. Additional future impacts include recharge of poor quality water to the deeper water supply zone, water-logging of property causing landscaping and foundation damage, and increased groundwater discharge and salinity loading to the Colorado River system. Mitigation methods include reduction of over-irrigation of lawns by voluntary and regulatory methods.
W81-01469

DIFFERENTIALS IN AGENCY POWER: DETERMINING INNOVATIVE CAPABILITY IN WATER RESOURCES AGENCIES,
Arizona Univ., Tucson. Dept. of Political Science.
J. Nienaber.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-161069, Price codes: A06 in paper copy, A01 in microfiche. Completion Report, September 1980. 96 p, 4 Fig, 3 Tab, 43 Ref, 1 Append. OWRT-B-054-ARIZ(1), 14-34-0001-7138.

Descriptors: *Federal government, *Water resources development, *Institutional constraints, *Political constraints, *Creativity, Administrative agencies, Governmental interrelations, Political aspects, Research priorities, United States, Federal jurisdiction, Legal aspects, Institutions, Constraints, Administration, Water management(Administrative), Administrative decisions, Planning, History.

Various internal agency characteristics and external environmental variables were examined that influence the capacity of an agency to take on new responsibilities, obtain increased appropriations/personnel, and establish a predominance within the agency's area of operation. By carrying out a detailed historical analysis of seven Federal agencies (Bureau of Reclamation; Bureau of Land Management; Corps of Engineers; Fish and Wildlife Service; Forest Service; National Park Service; and Soil Conservation Service), six variables were isolated that impact on an agency's ability to innovate. Relative measures of agency appropriations, work force size and perceived status rankings were established through a cross-validation of the historical data, and an agency innovation model was developed. Using this approach, explanation of the strength of some agencies relative to other agencies was assessed. Federal perception of agency strength from interviews with middle/upper level officials of the seven agencies (ranking the other six agencies on four variables: relative power within Executive Branch; close relationship with Congress; Interest Group support; quality of response to NEPA), ranked the Corps of Engineers highest and the Forest Service, second. (Zielinski-IPA)
W81-01470

VULNERABILITY OF WATER SUPPLY SYSTEMS TO DROUGHTS,
Utah Water Research Lab., Logan.
D. S. Bowles, T. C. Hughes, W. R. James, D. T. Jensen, and F. W. Haws.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-163578, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Planning Series UWRL/P-80/08, December, 1980. 67 p, 7 Fig, 13 Tab, 33 Ref. OWRT-A-042-UTAH(1), 14-34-0001-9047.

Descriptors: *Droughts, *Drought vulnerability, Stochastic processes, *Model studies, *Utah, Drought tolerance, Water supply, Irrigation, Municipal water, Drought effects, Salt Lake County(UT), Utah 1977 drought.

This summary completion report describes the project work completed in three areas: (1) the development and preliminary testing of drought severity and vulnerability indices, (2) the impacts of Utah's 1977 drought, and (3) an operation comparison of stochastic streamflow models. The drought indices were evaluated for three municipal and three irrigation water supply systems in Utah. It was concluded that a continuous loss function to define the effects of water shortage would be more appropriate than the existing assumption that drought-related losses occur suddenly at a certain degree of water shortage. Information on the impacts of Utah's 1977 drought was collected by surveys of municipal and rural domestic systems, water users in Salt Lake County, and farmers, stockmen, ranchers, and irrigation company officials. Survey results were used to examine drought effects in different regions of the state and with respect to size of municipal supply systems. Despite severe restrictions placed on Salt Lake county water users most did not consider the experience an 'undue burden'. The comparison of five stochastic streamflow models on four Utah streams lead to a preliminary model choice strategy which is based on the historical estimates of the lag-one autocorrelation and Hurst coefficients.
W81-01493

CHANGE: A MANAGEMENT PROBLEM OR A PROBLEM WITH MANAGEMENT,
Honolulu City and County Board of Water Supply, HI.
K. Hayashida.
Journal of the American Water Works Association, Vol 72, No 11, Part 1, p 612-613, November, 1980.

Descriptors: *Management, *Productivity, *Water works, Public utilities, Personnel management, Administration, Employee relations, Honolulu, Costs.

Management of water utilities must respond to changes in order to maintain productivity. Examples of implementing changes with minimum employee resistance are given from an experience in the Honolulu Board of Water Supply. Overtime was cut from $400,000 in 1974 to $256,000 in 1975 by transferring some tasks to other city departments and managing overtime requests more carefully. Staff cut-backs were made slowly through attrition and assigning certain jobs to outside contractors. Take-home cars for emergency transportation were reduced from 73 to 42, with immediate complaints from affected personnel but considerable savings to the utility. The department was decentralized from a vertical pyramid with 5 major divisions into 9 divisions with shorter lines of communication to the executive level. (Cassar-FRC)
W81-01549

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

PRELIMINARY ANALYSIS OF HYDROPOWER PRODUCTION FEASIBILITY AT TWENTY-ONE EXISTING DAM SITES IN THE STATE OF MINNESOTA,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 6B.
W81-01430

6D. Water Demand

TREATED WATER DEMAND AND THE ECONOMICS OF REGIONALIZATION: VOLUME 1. THE RESIDENTIAL DEMAND FOR TREATED WATER,
Alabama Univ., University.
B. P. Helms, and J. F. Vallery.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-145617, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-162, August, 1980. 93 p, 5 Fig, 14 Tab, 22 Ref, 3 Append. R805617.

Descriptors: *Domestic water, *Water demand, *Water rates, *Economics, Water utilization, Lawns, Water conservation, Irrigation practices, Pricing, Income, Appliances.

The present and future demands and costs for residential water are examined in view of the new requirements for water quality standards under the Safe Drinking Water Act of 1974. The determinants of residential water demand, including water price, family income, and appliance ownership were investigated using data from two surveys of utility customers. A methodology was developed by which utilities can determine future customer demand. It was found that the number of persons in the home and family income are the most important determinants of water consumption. Price affects consumption, but much less than has been indicated in most previous studies. The presence of various water-using appliances affects the use of water, but this is generally a reflection of income, and therefore information on appliances may be redundant if accurate income data are available. The percent of customers irrigating increases with income, but heavy waterers are found scattered throughout the moderate-to-high income levels, and are in the minority at all income levels. Completely eliminating lawn irrigation cannot greatly curtail the need for new water supplies, since irrigation water accounts for only about 3.5% of total use. Significant water conservation is unlikely to be achieved through the use of rational rate increases. Future reductions in water demand will more than likely come from technological changes in the household water-consuming appliances. An increasing block rate structure may be feasible only in systems with computerized billing systems, and it would induce only limited conservation with relatively high, widely publicized rates. The primary advantage would be that the revenue would be collected from these primarily responsible for the peak load. (Moore-SRC)
W81-01442

BREAKING THE COST BARRIER TO HOUSEHOLD WATER SERVICE,
E. F. Lowry.
Journal of the American Water Works Association, Vol 72, No 12, p 672-677, December, 1980.

Descriptors: *Domestic water, *Cost analysis, Water costs, Water distribution(Applied), Construction costs, Water utilization, Potable water, Water demand, *Philippines.

The Barangay Water Program in the Philippines is used as an example of one way of providing economically feasible water systems connected to private households in rural, low income areas in developing nations. A key aspect of the success of this program has been the reduction of the per capita construction cost as much as possible. The Barangay Water Program under the Ministry of Local Government and Community Development set forth a technical manual covering design criteria that are to be used, determinations for size and locations of storage, selection of pipeline sizes, presentations of materials specifications, and prepartion cost estimates. This approach has allowed the program to proceed under sound economic designs. Much of the cost reduction seen in the program has resulted from the standardization of design criteria. Additional savings were realized through the use of standardized storage in a standpipe configuration instead of conventional elevated storage tanks. The choice of materials was the last factor which contributed to the cost reductions. The potential for consumption would indicate that the day begins with the equivalent of 5 cans of water (each can equalling a 5 gal kerosene can) in storage per home. The water enters the home at the rate of 23 liters (6 gal) per hour. Level 3A services such as this were in place in 8 diverse locations around the Philippines by May, 1980. In the future a water system is expected that will pipe water into rural areas at 450 liters (120 gal) per day in the home for less than $21 per capita construction cost. (Baker-FRC)
W81-01548

6E. Water Law and Institutions

EFFECTS OF WATER QUALITY ON FISH,

Purdue Univ., Lafayette, IN. Dept. of Forestry and Natural Resources.
For primary bibliographic entry see Field 5C.
W81-01504

NATIONAL MUNICIPAL POLICY AND STRATEGY: TIGHTENING THE SCREWS,
D. V. Feliciano.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 3-7, January, 1980. 1 Fig, 1 Tab.

Descriptors: *Water quality control, *Legislation, *Clean Water Act, National Municipal Policy and Strategy, Government supports, Permits, Water policy, EPA, Water institutions.

The National Municipal Policy and Strategy was signed by the EPA in 1979 and is viewed as a vehicle for dealing with the almost 60% noncompliance of some 17000 publicly owned treatment works (POTWs). These POTWs were failing to cooperate with the 1977 guidelines and treatment requirements that had been previously established. The municipal strategy will permit examination of those POTWs that are not in compliance with the standards set in 1977 and will determine whether they are eligible for extension of the deadline provided for under the Clean Water Act. Specific compliance schedules will be drawn where applicalbe. In cases where enforcement is necessary, the municipal strategy will coordinate this with the availability of construction grant funds and with reordered state priority lists. (Baker-FRC)
W81-01507

WATER QUALITY MANAGEMENT-HAVE WE LOST SIGHT OF THE OBJECTIVE,
Mathematical Sciences Northwest, Inc., Bellevue, WA. Consulting Div.
G. R. Minton.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 131-141, March, 1980. 50 Ref.

Descriptors: *Federal Water Pollution Control Act, *Water management, Planning, Water quality, Water pollution sources, Local government, Federal government, Water quality control, *Water pollution control, Pollution abatement, Federal government, Water resources development, Water policy, *Water quality standards.

After the passage of the Federal Water Pollution Control Act Amendments in 1972, the water pollution control strategy of the United States was criticized by the General Accounting Office, the business community, scientists and professional agencies, and the National Resources Defense Council. The general complaints have focused upon the strategy's attempts at control of effluents rather than concentrating on a long-term strategic approach to achieving better water quality. The need to put receiving-water considerations back into water management decisions is stressed. To deal successfully with nonpoint pollution sources, studies must be made on the seasonality of certain beneficial uses as well as on water quality. Effective parameters must be adopted in monitoring nonpoint pollution. The evaluation of the integrity of the biological community has been suggested as an indicator or receiving water reaction to nonpoint pollution sources, but such a system would require vast sums of money for research. Little data exists on the potential benefits of improved water quality, but this situation is expected to be remedied under the 1977 Amendments. Under a proposed plan for improved water quality management, emphasis is given to nonpoint pollution, the role of local governments, monitoring, the handling of policy conflicts, the use of incentives, new technical tools and natural resource management. The need for integration of environmental objectives in urban areas is also discussed. (Geiger-FRC)
W81-01510

MANAGEMENT OF US WATER RESEARCH,
North Carolina Water Resources Research Inst., Raleigh.
N. S. Grigg.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 143-158, March, 1980. 10 Fig, 19 Ref.

Descriptors: *Water management, *Water Resources Research Act, Water resources, Planning, Administrative agencies, Research and development, Federal government, State government, Water policy, Water quality, Water law.

The United States' organizations for managing water research exist at five levels: international, national, agency, organization and project levels. The international organizations include such groups as UNESCO, WHO, and WMO. No single main national organization exists for water research in the United States, and organizational level facilities may occur in academic, government-controlled or private-sector institutions. It is estimated that an evaluation of the effectiveness of these organizations would take a substantial effort. The technology adopted to manage the US water resources has been described as a function of the quality of life society wishes to attain. Water management involves budgetary decisions and energy and manufacturing considerations on an intergovernmental level. The contributions of utilities, industries and water associations have not been fully recognized when establishing water research fund allocations. Input from these sources has been recently taken into account under the National Science and Technology Policy, Organization, and Priorities Act of 1976. New and expanded programs will be needed at the federal level to serve state and local governments and coordinate the intergovernmental aspects of water resource managment. (Geiger-FRC)
W81-01512

BREAKING THE COST BARRIER TO HOUSEHOLD WATER SERVICE,
For primary bibliographic entry see Field 6D.
W81-01548

ECONOMIC DREAM OR ENVIRONMENTAL NIGHTMARE. THE LEGALITY OF THE 'BUBBLE CONCEPT' IN AIR AND WATER POLLUTION CONTROL,
Lewis and Clark Coll., Portland, OR. Natural Resources Law Inst.
J. L. Landau.
Boston College Environmental Affairs Law Review, Vol 8, No 4, p 741-781, 1980. 224 Ref.

Descriptors: *Water pollution control, *Bubble concept, *Environmental control, *Regulation, Air pollution, Legal aspects, Administrative agencies, Legislation, Water quality standards, Control, Clean Air Act, Legislation, Water Quality Act, Water policy, Water institutions, *Economics.

The 'bubble' concept or alternative emission reduction options policy is a reform proposed by the U.S. EPA to improve economic efficiency in its regulatory program. This concept offers industries an incentive to develop effective pollution control technology at the least cost. As an example, if an imaginary bubble were placed over a factory, the industry would be responsible for the total emissions, not emissions from individual pipes or stacks. The bubble concept is applied to water pollution control as well as to air pollution. The question is how to define 'point source', whether it can be considered an entire plant as opposed to individual pipes and processes. Much debate on the merits and disadvantages of the water pollution bubble system had taken place within the government, and the status of such a policy remains indefinite. Some of the objections are increased need for regulatory personnel, development of bargaining between agencies and industries, threats of environmental degradation, difficulty of verification, and mistrust of industries to comply in good faith. Rebuttals to these statements respectively cite great cost savings for industry and indirectly for the consumer, present and past use of negotiations, no change in character or quantity of discharges, and noncompliance by some businesses no matter what the system. (Cassar-FRC)
W81-01605

6F. Nonstructural Alternatives

WATER QUALITY AND WESTERN ENERGY - WHAT ARE THE TRADE-OFFS,
J. T. Dale.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 8-14, January, 1980. 1 Fig, 3 Tab.

Descriptors: *Water quality control, *Resources development, *Energy, Runoff, Salinity, Land management, River basin development, Water resources planning, Colorado River, Mexican Water Treaty.

The development of potential sources of energy in the western states of Montana, North Dakota, South Dakota, Wyoming, Colorado, Utah, Arizona, and New Mexico, and the impact of such development on the quality of water in the Colorado River are discussed. Both the Upper Colorado and the Upper Missouri river basins will be affected, but the former will suffer the most from the development. The water of the Colorado is already overobligated, according to some experts, and is creating a water deficiency/water quality problem in violation of a treaty with Mexico. Increased demands will only hurt the situation. Major efforts will have to be made to prevent increases in stream salinity resulting from concentration effects. Choices include better control of point sources, better control of non-point sources, or treating surface water through desalination plants. With energy development in this area, population increases are also expected, with added municipal effluent effects on the water quality. Various suggestions for improving water quality include control procedures, improved design of holding ponds, pretreatment of effluents prior to pond discharge, selection of energy conversion facilities in locations which minimize water quality problems, secondary and tertiary waste water treatment, land applications of municipal waste water, reduction of runoff from energy facilities, and reduction of runoff from agricultural lands. (Baker-FRC)
W81-01506

6G. Ecologic Impact Of Water Development

ECOLOGICAL ASPECTS OF LAKE NASSERNUBIA,
For primary bibliographic entry see Field 2H.
W81-01564

THE WATER BUDGET OF LAKE QARUN AND ITS PHYSICO-CHEMICAL CHARACTERISTICS,
Economics, Statistics, and Cooperatives Services, Broomall, PA.
For primary bibliographic entry see Field 2H.
W81-01565

SOME ENVIRONMENTAL ISSUES IN WATER FOR DEVELOPMENT,
United Nations Environmental Programme, Nairobi (Kenya).
L. E. Obeng.
Water Supply and Management, Vol 4, No 3, p 115-128, 1980. 2 Fig, 2 Tab.

Descriptors: *Regional development, Regional economics, Water management(Applied), Water distribution(Applied), *Water supply development, Water resources development, *Environmental effects, Developing countries, Ecosystems.

The major environmental issues in water use for development are the availability of adequate water, water quality, the significance of water in productive ecosystems, and the efficient management of water resources. Proper resources management may include the establishment of an institutional structure to support information gathering and dissemination. Management problems are shared by most countries. Generally, manpower, equipment, and money are not sufficient for proper management. The most basic problems nations may face are the lack of sufficient water or the poor quality

of the water that is available. While water treatment and waste and sewage treatment are important, they are expensive and often beyond the means of a developing nation. The effects of necessary dams and irrigation must be considered. Water management is necessary for the improvement of life, food, shelter, clothing, and health of developing nations. (Small-FRC)
W81-01566

PHYSICO-CHEMICAL CONDITIONS, FAUNA AND FLORA OF LAKE MANZALA, EGYPT,
Alexandria Inst. of Oceanography and Fisheries (Egypt).
For primary bibliographic entry see Field 2H.
W81-01567

STUDIES ON THE CHANGES OF SOME ECOLOGICAL FACTORS AFFECTING FISH LIFE IN LAKE QARUN, FAIYUM, EGYPT,
Faculty of Science, Sohag (Egypt). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W81-01568

THE ENVIRONMENTAL DIMENSION IN WATER MANAGEMENT: THE CASE OF THE DAM AT SALTO GRANDE,
Bariloche Funacion, San Carlos de Bariloche (Argentina).
G. Gallopin, T. R. Lee, and M. Nelson.
Water Supply and Management, Vol 4, No 4, p 221-241, 1980. 5 Fig, 4 Tab, 6 Ref.

Descriptors: *Water management, *Model studies, *Dams, Water resources development, Ecosystems, Future planning, Social aspects, Water quality, Environmental effects, Economics, International commissions, Quality control, Dam construction, *Uruguay River, *Argentina, *Uruguay.

A bi-national Technical Commission (CTM) was formed to handle the project of construction of a dam at Salto Grande on the Uruguay River. CTM initiate numerous study programs to develop regulatory and management criteria to maintain environmental quality in the area that the dam would affect, which included land from the nations of Uruguay and Argentina. A workshop attended by CTM members defined the system to be controlled and gave as the main objective of the system the maintenance of the quality of life. This system was subdivided, yielding an economic and socio-cultural subsystem which was in direct interaction with a physical subsystem to maintain the integrity of air, water, soils, and terrestrial and aquatic biota. To gather information as quickly as possible and enhance inter-disciplinary communications, a questionnaire approach was adopted. The questionnaire focused on indicators of the state of each sector and attempted to highlight significant associations that might exist between sectors. A second workshop compiled data from the questionnaire and generated flow diagrams for each sector, showing interactions between systems. A final CTM workshop clarified actions which impacted on the water sector, the soil and terrestrial flora and fauna sector, the socio-economic sector, and actions which had chain effects through several systems. It was concluded that the model offered a viable organizational framework for coordinating research on an array of natural and social sciences. (Geiger-FRC)
W81-01572

7. RESOURCES DATA

7A. Network Design

SAMPLING: DEFINING THE TASK AND PLANNING THE SCHEME,
Water Research Centre, Marlow (England). Medmenham Lab.
J. C. Ellis, and R. F. Lacey.
Water Pollution Control, Vol 79, No 4, p 452-467, November, 1980. 8 Fig, 1 Tab, 4 Ref.

Descriptors: *Statistical methods, *Sampling, *Streams, Water sampling, Streamflow, Effluent streams, Influent streams, Project planning, Methodology.

Applying statistical planning increases the effectiveness of stream sampling, which includes rivers, streams, effluents, and influents. The paper emphasizes how the program design is influenced by the objective, the degree of tolerable imprecision, assumptions concerning variability in the system, and available resources. A clear objective is necessary to gather the proper amount of relevant information. Some possible objectives are as follows: to spot abnormal concentrations, to define peaks, to gather general information, to estimate mean concentration, to detect changes, to monitor processes, to determine a fair industrial effluent charge, to estimate a percentile, and to monitor for compliance. Specific instructions, as well as examples of applying the statistical method, are given for each of these objectives. (Cassar-FRC)
W81-01627

7B. Data Acquisition

DETECTION OF WATER QUALITY CHANGES THROUGH OPTIMAL TESTS AND RELIABILITY OF TESTS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. W. Koch, T. G. Sanders, and H. J. Morel-Seytoux.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-161028, Price codes : A07 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report No 104, September, 1980. 123 p, 28 Fig, 21 Tab, 12 Ref, 5 Append. OWRT-B-186-COLO(2), 14-34-0001-8069.

Descriptors: *Water quality changes, Water quality monitoring, *Mathematical models, Water quality management, Hydrologic data, Simulation analysis, Statistical methods, Correlation analysis, Evaluation, *Time series analysis.

The detection of change in a hydrologic variable, particularly in water quality, is a current problem. A method of formulating this problem in a mathematical programming context is presented. The method is based on using weighted linear combinations of water quality variables from different locations with the weighting factors being adjusted so that the time required to detect the change is minimized. The basis of the technique, then, is a trade-off of time by adding information from other locations. The results of example applications show that significant savings in time can be achieved by using this method. Since the detection method is based on sample statistics developed from historic data, uncertainty exists as to how accurately the optimal values of the time required to detect the change and the weighting factors reflect the true, but unknown, values. A method of evaluating the reliability of these estimates is presented using an analytical solution of the optimization problem. Through this approach, expressions are obtained relating explicitly the optimization variables to the random variables of the problem, giving a clear picture of the interrelationships. Simulation is then used to evaluate the behavior of the optimization variables through these explicit relations.
W81-01466

ANALYSIS OF DIGITIZED M-33 RADAR DATA FROM TEXAS HIPLEX, 1976-1978,
North American Weather Consultants, Salt Lake City, UT.
For primary bibliographic entry see Field 3B.
W81-01480

A REMOTE SENSING TECHNIQUE TO MONITOR CLADOPHORA IN THE GREAT LAKES,
Environmental Research Inst. of Michigan, Ann Arbor.
F. J. Tanis.
Environmental Protection Agency Report EPA-600/3-80-075, July, 1980. 36 p, 12 Fig, 4 Ref. R803611.

Descriptors: *Great Lakes, *Cladophora, *Remote sensing, *Eutrophication, Lake Ontario, Algae, Nuisance algae, Aquatic plants, Biomass, Analytical techniques, Distribution, Water pollution, Standing crops, Monitoring, Mapping, *Aerial photography, Multispectral scanner.

The presence of the nuisance alga Cladophora along parts of the Great Lakes shoreline is one of the negative consequences of excess inputs of pollutants into the Lakes and their contributing rivers and streams. An airborne multispectral scanner was used to monitor Cladophora at two sites on the Lake Ontario shoreline near Rochester, New York. Computer generated color maps were produced to show spatial distribution of Cladophora in the nearshore zone and to estimate standing crop. Recognition of Cladophora biomass from aircraft imagery requires gathering Cladophora samples at known locations. Sampling locations can be marked with highly reflective floats which are visible in the multispectral imagery. The use of multispectral digital instrumentation allows development of automatic recognition techniques. Results can be displayed as high resolution maps for selected areas and to compile standing crop estimates over large reaches of shoreline. Specific influences of local sources of nutrients of various environmental contaminants on the growth and extent of Cladophora should be monitored using this aerial technique with multiyear surveys. Improvements in local water quality as a result of implementation of remedial programs can be expected to affect Cladophora growth and therefore are observable in the airborne surveys. (Moore-SRC)
W81-01486

RECOMMENDATIONS FOR USE OF SI UNTS IN HYDRAULICS,
M. S. Petersen.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY12, p 1981-1994, December, 1980. 11 Tab, 8 Ref.

Descriptors: *Construction, *Standards, *Measurement, Technical societies, Metric system, International System of Units, Hydraulics, Hydraulic engineering, *International system of units(SI).

Basic information is presented on the International System of Units (SI), including recommended units, in a suitable form for hydraulic engineers The following are included: a table for conversion to SI units of physical quantities frequently used in water resources practice, such as acceleration, energy/area-time, force, and heat; and tables of equivalent units for length, area, volume, flow rate, velocity, mass, force, and physical properties. The information presented is the result of meetings and questionnaires from the ASCE Committee on Metrication. While changeover to the use of SI is voluntary, the changeover is to start in the construction industry on January 1, 1981. By January 1, 1985, most of the construction industry will work in the metric system. (Small-FRC)
W81-01520

CO-ORDINATION OF MODELS IN SOFTWARE SYSTEMS FOR LARGE SCALE WATER RESOURCES PROJECTS,
Soyuzgiprovodkhoz, Moscow (USSR).
For primary bibliographic entry see Field 6A.
W81-01573

A DESIGN FOR A SIMPLE UNDERWATER IRRADIANCE METER,
Liverpool Univ., Port Erin (England). Dept. of Marine Biology.
T. H. Moller, and H. Bailey.
Estuarine and Coastal Marine Science, Vol 11, No 3, p 347-352, September, 1980. 5 Fig, 9 Ref.

Descriptors: *Instrumentation, *Light intensity, *Irradiation, Performance, *Aquatic animals, Aquatic environment, Calibrations, Measurement,

Light attenuation, Light penetration, Extinction coefficient.

The assembly, calibration, and performance of an irradiance meter intended for underwater measurements in a single waveband are described. The meter utilizes seven Clairex cadmium sulfide photoconductive sensors and a Field Effect Transistor Volt Ohm Meter to measure changes in resistance of the coupled photoconductors. Calibration follows the method of Jones (1970) and Arnold (1975). A calibration curve was constructed by placing a succession of neutral density filters in a known light path. The irradiance meter is simple to deploy and operate even from small vessels. Since the meter is independent of an external power source, a diver can take in situ irradiance readings. At depths of 70 m, 60 seconds are required to obtain a constant reading. Ten to the minus 7th watts per square meter represents the minimum irradiance level which is accurately detected by the meter, but the response time of about five minutes for values below ten to the minus 6th watts per square meter may in some cases be impractical. Instrument performance is discussed in relation to angular light response, immersion effect, response time, temperature dependence, and filter band width error. (Small-FRC)
W81-01587

8. ENGINEERING WORKS

8A. Structures

APPARATUS FOR PROTECTING AQUATIC LIFE PASSING THROUGH A WATER FILTER,
Passavant Corp., Birmingham, AL. (Assignee).
R. McCawley, and K. R. Siddle.
U.S. Patent No 4, 199,453, 7 p, 5 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 993, No 4, p 1373, April 22, 1980.

Descriptors: *Patents, *Intakes, *Powerplants, *Aquatic life, Filters, Entrainment, Engineering structures, Impingement.

An apparatus for protecting aquatic life carried by water passing through a vertical traveling band screen unit has inwardly opening screening baskets. Each basket carries a longitudinally extending, inwardly projecting baffle adjacent its trailing side with the portion adjacent the basket being imperforate. The area along the length of each basket at the inner side of the baffle is imperforate and defines with the baffle a pocket for receiving water and aquatic life carried upon upward movement through the water. It is adapted to discharge the water and aquatic life upon movement of the pocket to a predetermined elevation. A low pressure stream of water transfers the aquatic life from the pocket to a discharge trough located inwardly of the screening unit. (Sinha-OEIS)
W81-01444

RELIABILITY OF DAMS SUBJECTED TO HYDRODYNAMIC FORCES DURING EARTHQUAKES,
Delaware Univ., Newark. Dept. of Civil Engineering.
V. Chiarito.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-163594, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, June, 1981. 97 p, 20 Fig, 18 Tab, 18 Ref, 5 Append. OWRT-A-047-DEL(3), 14-34-0001-0108.

Descriptors: *Design criteria, *Dams, *Reservoirs, Earthquakes, *Hydrodynamics, Structural geology, Engineering structures, Equations, Random hydrodynamic force, Delaware, Hoopes Dam(DE).

The assumptions and formulation of the governing wave equation are presented for the dam-reservoir system. The equations for the random hydrodynamic force and moment response are derived in a nondimensional form. Using random vibrations theory reliability functions are formulated for stability criteria concerning sliding and overturning. An application of the final results to Hoopes Dam in Delaware is presented. In this thesis the safety of the dam-reservoir system is analyzed by a probabilistic approach. Other works are cited; and nonstationary models used for the acceleration and response force are explained. The equations involve integrals with no known analytic solution. Thus, the integrals need to be evaluated numerically. All the numerical results are presented and discussed. Comparisons to approximate solutions are made to determine the validity of the numerical results. Finally, extensions from this study for future research are noted.
W81-01495

UPGRADING THE OLD WHILE BUILDING THE NEW,
Inca, Ltda, Cali (Colombia).
For primary bibliographic entry see Field 5F.
W81-01547

PLANNING A 2300-FOOT TOTAL DYNAMIC HEAD WATER SYSTEM,
Wiley and Wilson, Inc., Lynchburg, VA.
W. S. Shenk.
Public Works, Vol 111, No 4, p 84-87, April, 1980. 2 Fig.

Descriptors: *Pipelines, Pumping, *Distribution systems, Water demand, Seasonal, Planning, Water management, *Recreation facilities, Water utilization, *Design criteria, *Appalachian Mountain region(VA), Virginia, Golf courses, Water hammer, Water supply.

The engineering of a water supply system for the Wintergreen Ski Resort atop the Appalachian Mountains of Virginia is described. The 2,150 feet of static lift from Lake Monocan, the nearest possible water source, to the mountain storage tank is spread over distinctly different mountain and valley segments. Maximum continuous demands over the winter may reach 1,400 gpm or 2 mgd. Several high pressure pump systems were evaluated in the design stage, and the system chosen for use involved a Lake Monocan pump station, a valley pipeline (17,000 feet), Peggy's Pinch pump station, a mountain pipeline (7,650 feet), and a mountain storage tank (250,000 gallons). The lake pumping station may be relocated if the lake is enlarged. The Peggy's Pinch station has two 700-gpm pumps with controls and welded steel piping that conforms to standards required in petroleum transport. To account for pressure rise due to instantaneous closures (water hammer) several surge protection devices were installed with automatic check valves. Spherical shock traps which were designed for data based on computer simulations of the worst possible water hammer situtation were also installed. Selection of pressure piping based on the hoop stress formula resulted in the use of ASTM A53 or API 5L, Grade B pipe with a yield strength of 35,000 psi. The mountain top reservoir serves the snow making machinery and golf course irrigation system and supplements domestic use when demand exceeds capacity of existing wells. The system has been operating since the 1974-75 ski season with essentially zero down time. (Geiger-FRC)
W81-01633

RETENTION BASINS: KEY TO STORM DRAINAGE PLAN,
Barrett, Harris, and Associates, Inc., Menlo Park, CA.
F. H. Barrett, Jr., and A. Petrie.
Public Works, Vol 111, No 3, p 67-70, March, 1980. 2 Fig, 2 Tab.

Descriptors: *Retention, *Storm runoff, *Basins, *Water storage, Urban drainage, Storm drains, Planning, Water management, California, Watersheds, Recreation, Project feasibility, Economics, Design criteria, Flood control, *Manteca(CA).

Reevaluation of the Manteca, California storm drainage fee structure in 1974 revealed that surface runoff discharge facilities were inadequate to handle storm conditions. Of the options available to correct the situation, the most practical in terms of costs and legal considerations was the construction of a system of retention basins. Design criteria were based on occurrence of an intense storm every 5 years, and peak unit flow calculations were estimated from land use, tributary area and total peak flows. Retention basins applicable to the study area which were examined included those with total gravity flow, those requiring pumping at inlet only, and those necessitating pumping only at the outlet. Different variables are considered which would influence the design of a basin. The drainage facility may be used for recreation nearly 80% of the time in most areas in California; safety and maintenance factors accompanying this dual use are discussed. A non-pumping drainage plan is usually favored. Since the original master drainage plan was completed in 1974, Manteca has completed 3 successful retention basins. Percolation basins may be feasible for recharging groundwater supplies in other areas where the water table is lower. Financial aspects of the storm drainage master plan were reviewed from the viewpoint of the residents, developers, and cities planning and managing committees. (Geiger-FRC)
W81-01637

DEFLECTION MECHANISM OF PVC SEWER PIPE,
Uni-Bell Plastic Pipe Association, Dallas, TX.
W. D. Nesbeitt, and R. T. Walker.
Public Works, Vol 111, No 3, p 79-83, March, 1980. 5 Fig.

Descriptors: *Flexibility, *Plastic pipes, Defection, Sewers, Piping systems, Pipes, *Pipelines, Engineering structures, Soil mechanics, Rigid foundations, Flexible foundations.

The deflection mechanism and uses of flexible polyvinyl chloride (PVC) sewer pipes are discussed. The engineering profession has long recognized the good long-term performance of PVC buried pipe. As flexible pipe defects, the vertical force vectors derived from the load (soil weight, superimposed dead load or superimposed live load) are distributed effectively through the defection mechanism into the surrounding embedment soil. The effects of soil arching and negative soil arching are outlined for both rigid and flexible pipes. For flexible pipes, the Marston formulas for calculating loads imposed on buried pipes are valid for narrow trench conditions. Research on the relationship between contact pressure and pipe flexibility has shown that the effective force vector distribution can provide substantial benefits when pipes of sufficient flexibility are premitted to deflect under load. The critical performance limits for different flexible pipe products have been defined in terms of their percent deflection. PVC sewer pipe (ASTM D 3034 DR 35) will not fail at a deflection equal to or less than 30% with a safety limit of 7.5%. Satisfactory operations of PVC pipe have been recorded for North American and some sites in Europe. Trial ASTM D 3034 DR 35 pipelines installed in the difficult soil conditions of the Netherlands are providing good long-term structural strength. (Geiger-FRC)
W81-01639

AUSTIN'S INTERCEPTOR AND TREATMENT PLANT: ENGINEERING WONDER,
Water and Waste Water Dept., Austin, TX.
C. E. Johnson.
Public Works, Vol 111, No 4, p 69-73, April, 1980. 1 Fig.

Descriptors: *Sewage treatment, Tunnels, *Waste water treatment, *Treatment facilities, Discharge lines, *Austin(TX), Texas, Colorado River, *Design criteria, Urban development, Filtration, Odor, Sludge treatment, Industrial wastes, Costs, Instrumentation, Grants.

The interceptor tunnel of Austin, Texas and its main treatment facility, the Govalle plant, are described. The tunnel, which was designed to service population expansion into the northwest and east sectors of the city, was completed in 1975, and its discharge facility, the Walnut Creek treatment plant, in 1977. The tunnel operates by gravity flow and is 11 miles long with a 7-8 foot diameter. A

backwashing system was installed to assure a flushing velocity in the tunnel. Air louvers were provided at the inlets to control odors and keep the entire system aerobic. Metering devices allow diversion of flows to either the Govalle or Walnut Creek plant to evenly distribute treatment loads. Equalization basins double as primary clarifiers to give storm flows (up to 76 mgd) at least primary treatment and chlorination. Austin has placed limitations on all industrial and some municipal discharges into the sewer system. The waste water treatment plant was designed to be aesthetically pleasing to nearby residents. The treatment cycle now includes screening, grit removal, primary settling, flow equalization, activated sludge treatment, chlorination, and effluent filtration. Effluent filtration is accomplished by dual media gravity filters. Sludge is thickened at the Walnut Creek site and pumped to lagoons on the Colorado River seven miles away. Air filtration is carried out with granulated carbon absorbers to control odors. Delays in planning and construction occurred due to transitions in Federal grant programs. The costs for the interceptor tunnel and new treatment plant were $21 and $35.2 million, respectively. (Geiger-FRC)
W81-01641

8B. Hydraulics

MEASUREMENTS IN MERGING FLOW,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
W. H. C. Maxwell, and A. Snorrason.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-163545, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois, Research Report No 155, January, 1981. 38 p, 17 Fig, 2 Tab, 44 Ref. OWRT-A-103-ILL(1), 14-34-0001-0115.

Descriptors: *Diffusion-flow, *Flow characteristics, *Flow profiles, *Fluid mechanics, Jets, Mixing, Velocity, Turbulent flow, Testing procedures, Submerged turbulent jets, Merging flow, Reverse flow.

Previous measurements of the velocity field in the vicinity of two intersecting submerged turbulent jets provided evidence that, contrary to the usual assumptions, intersecting flows may not necessarily be combined using vector addition of velocities or momentum flux densities. To gather additional experimental evidence on the details of the velocity field near the intersection of two submerged turbulent jets, this study measured time average velocity magnitudes and directions of two perpendicular intersecting axisymetric submerged turbulent incompressible air jets of approximately equal strength. Because of the need to detect reverse flows, a three-dimensional pilot-type probe was used. This could sense yaw and pitch angles as well as velocity magnitudes. Two sets of measurements were taken. The more detailed set was confined to the plane of the nozzles, the less detailed set obtained cross-sectional data at four stations, three of these being in the observed reverse flow. The data show that the reverse flow spreads much more rapidly perpendicular to the nozzle plane than in the nozzle plane, whereas the forward flow is fairly symmetric. Similarity profiles were found in both the forward and reverse flows. In the forward flow the distribution was essentially Gaussian. This was also true in the backward flow in the direction normal to the plane of the nozzles. In the plane of the nozzles the backward flow profiles were close to semi-elliptical or semi-circular, depending on the scales for plotting.
W81-01490

RECOMMENDATIONS FOR USE OF SI UNTS IN HYDRAULICS,
For primary bibliographic entry see Field 7B.
W81-01520

8D. Soil Mechanics

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Russell and Axon, St. Louis, MO.
For primary bibliographic entry see Field 4C.
W81-01636

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 14, NUMBER 10
MAY 15, 1981

W81-01651 -- W81-01900
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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

VOLUME 14, NUMBER 10
MAY 15, 1981

W81-01651 -- W81-01900

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Office of Water Research and Technology. The cumlative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

WATER RESOURCES OF THE COOK INLET BASIN, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-01671

MAN OUTMATCHES MATH MODELS FOR FLOOD FREQUENCY,
Pima County Flood Control Districts, Tucson, AZ.
B. M. Reich.
Public Works, Vol 111, No 7, p 56-57, July, 1980. 1 Fig, 2 Tab.

Descriptors: *Graphical analysis, *Flood forecasting, *Mathematical models, Streamflow, Analytical techniques, Graphical methods, Flood protection, Flood data, Flow rates, Flood control.

A mathematical graphical method is described, based on sound statistical reasoning, that can be used to make estimates of the 100-year flood. The largest and smallest estimates obtained by 31 students with this method were 9,200 and 7,000 cfs for this example using 20 yr of good flood data from a 57.7 square mile watershed in Southeastern Arizona. Five common mathematical models were used for the same estimates, and the Q-100 values thus obtained ranged from 5,540 to 60,870 cfs from the same flood series. (Baker-FRC)
W81-01882

2B. Precipitation

DROUGHT AND OUR DESTINY,
T. C. Robertson.
Veldtrust (Johannesburg), p 4-7, Autumn, 1979.

Descriptors: *Droughts, *Africa, *Hydrologic budget, *Precipitation(Atmospheric), *Climatic data, Climates, Climatic zones, Effective precipitation, Climatology, Geographical regions, Regions, Foreign countries, Subtropic, Tropic, Meteorology, Water shortage, Water utilization, Rainfall, Weather forecasting, Probable maximum precipitation, Floods, Weather data, Moisture deficit, Vegetation effects, *South Africa.

A historical account is given concerning numerous attempts (since 1914) to give a scientific explanation of the problems posed by seasons of diminished rainfall in South Africa. The Drought Investigation Commission and the Select Committee of the Senate, which investigated droughts/rainfall/soil erosion in 1914, felt that if high/low rainfall cycles occurred, it should be possible to locate and predict them. In 1934 Schumann and Thompson divided the country into 32 rainfall districts and collected all weather data recorded during the past 55 years. In 1965, Midgley produced a runoff hydrograph (showing tall peaks of the 1943 and 1954 floods, and graph valleys for the 'great four years drought' (1930-1933)) for the river at Vaaldam. Worthington felt prior to the recent severe drought in the Sahel region, that the drought-striken parts of Africa might experience extensive depopulation during a prolonged cycle of drier years. An exhaustive 8-year analysis of rainfall statistics dating back to 1910 generated a graph indicating 10-year cycles of 20-30% higher to 20-30% lower rainfall than average. The country reached the peak of wet period by 1976 and is now on the decline to fall below average by 1981. (Zielinski-IPA)
W81-01750

2C. Snow, Ice, and Frost

COLUMBIA GLACIER, ALASKA: RECENT ICE LOSS AND ITS RELATIONSHIP TO SEASONAL TERMINAL EMBAYMENTS, THINNING, AND GLACIAL FLOW,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-01672

2D. Evaporation and Transpiration

EVAPORATION FROM A SPHAGNUM MOSS SURFACE,
North Central Forest Experiment Station, Grand Rapids, MN.
D. S. Nichols, and J. M. Brown.
Journal of Hydrology, Vol 48, p 289-302, November, 1980. 2 Fig, 2 Tab, 38 Ref.

Descriptors: *Evaporation, *Evapotranspiration, *Mosses, Peat, Energy budget, Wetlands, *Bogs, Hydrologic cycle, Temperature, Vapor pressure, Solar radiation, Minnesota, Great Lakes Region, *Sphagnum, Bowen ratio.

Peat cores, 45 cm in diameter, were collected from a sphagnum bog in northern Minnesota, and used to measure the effects of different temperatures and water levels on evaporation from a sphagnum moss surface in a growth chamber. Under all conditions, evaporation from the moss surface was greater than that from a free-water surface. Evaporation from the moss increased 92% as the temperature was raised from 9 to 25C. The energy used in evaporation from the moss exceeded net radiation except at 9C. Evaporation from the moss was less when the water level was at the surface of the peat than when it was lowered to 5, 10, or 15 cm below the surface. The presence of an overstory of grasses and sedges protected the moss from desiccation when the water level was 15 cm below the surface, but had no effect on total water vaporization at any water level. When the peat cores were maintained in the greenhouse for a year, changes in either the peat, the moss, or both occurred which resulted in significantly lower evaporation when measured in the growth chamber.
W81-01738

2E. Streamflow and Runoff

FLOW CHARACTERISTICS OF NEW MEXICO STREAMS, PART I. FLOW DURATION,
Geological Survey, Albuquerque, NM. Water Resources Div.
L. J. Reiland.
New Mexico State Engineer Special Report, 1980. 115 p, 9 Fig, 4 Tab, 2 Ref.

Descriptors: *Flow characteristics, *Streams, *Flow duration, Data collections, *Streamflow, New Mexico, Colorado, Oklahoma, Discharge(Water), Natural flow, Gaging stations, Sites.

Flow-duration tables have been developed from daily streamflow records collected at 156 gaging stations in New Mexico and parts of Colorado and Oklahoma. These tables show the percentages of time that various daily discharges were equaled or exceeded. Records for 32 long-term gaging sites having virtually natural flows were selected as index stations. By correlation with the long-term records, flow-duration data obtained at 70 short-term stations have been extended in time to represent data for a 43-year base period, 1931-73. Flow-duration data obtained at eight short-term stations have been extended to represent data for a 39-year base period, 1935-73. For 38 stations flow-duration tables are presented only for the period of record, there being no reliable basis for extending the record. (USGS)
W81-01667

STATISTICAL SUMMARIES OF SELECTED STREAMFLOW DATA--SOUTH PLATTE RIVER IN COLORADO AND NEBRASKA; NORTH PLATTE AND PLATTE RIVERS IN NEBRASKA,
Geological Survey, Denver, CO. Water Resources Div.
H. E. Petsch, Jr., K. B. Rennick, and C. F. Nordin, Jr.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225. Geological Survey Open-File Report 80-679, 1980. 278 p, 1 Fig, 3 Ref.

Descriptors: *Hydrologic data, *Streamflow, *Data collections, *Colorado, *Nebraska, Surface waters, Runoff, Gaging stations, Sites, Flow characteristics, Discharge(Water), *South Platte River(CO-NE), *North Platte River(NE), Platte River(NE).

This report is a compilation of statistical summaries of streamflow data for 22 gaging stations on the South Platte River in Colorado and Nebraska, and the North Platte and Platte Rivers in Nebraska. (USGS)
W81-01676

RESISTING THE DROUGHT,
T. C. Robertson.
Veldtrust (Johannesburg), p 7-9, Autumn, 1979.

Descriptors: *Drought, *Drought resistance, *Agroclimatology, *Africa, *Farm management, Hydrologic budget, Precipitation(Atmospheric), Environmental effects, Arid lands, Agriculture, Moisture deficit, Effective precipitation, Climates, Climatic zones, Climatology, Geographical regions, Regions, Foreign countries, Meteorology, Water shortage, Water utilization, Probable maximum precipitation, Groundwater, *South Africa.

An exhaustive 8-year analysis of rainfall statistics dating back to 1910 generated a graph indicating 10-year cycles of 20-30% higher to 20-30% lower rainfall than average. South Africa reached the peak of wet period by 1976 and is now on the decline to fall below the average rainfall level by 1981. The practical use to which farmers can put this knowledge is discussed. The author discusses soil erosion and various attempts undertaken since 1914 to create a public awareness of the drought problem. The 1923 'Blue Book' report and van Reenen's 1935 book, 'Resisting Drought', are discussed, calling attention to soil conservation, and factors as overgrazing, 'fodder banks', and burning the veld. The idea of conquering the dongas has been uppermost in the minds of soil scientists/engineers for many years and large-scale engineering attempts were made at Vlekpoort to 'cure' dongas. The new discipline of 'bioclimatology' (study of climate effects on life), and the science of agro-meteorology have provided advice to farmers to prepare against drought. (Zielinski-IPA)
W81-01749

DROUGHT AND OUR DESTINY,
For primary bibliographic entry see Field 2B.
W81-01750

AGRICULTURAL RUNOFF DURING A DROUGHT PERIOD,
Science and Education Administration, Lincoln, NE.
J. S. Schepers, E. J. Vavricka, D. R. Anderson, H. D. Wittmuss, and G. E. Schuman.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 711-719, April, 1980. 3 Fig, 7 Tab, 30 Ref.

Descriptors: *Runoff, *Agricultural watersheds, *Droughts, Precipitation(Atmospheric), Sediment transport, Sediment load, Nutrients, Water quality, Coliforms, Nebraska.

Basic research on agricultural runoff during a dry period is supplemented with specific examples from a 2025-ha agricultural water shed. Runoff from the Dee Creek watershed in Nebraska was analyzed over a three-year period of less than normal precipitation. Runoff amounted to less than 2% of the incoming moisture, and sediment losses were less than 0.7 metric ton/ha-year. Nutrient losses associated with the sediment averaged 74% of the total N losses and 76% of the total P losses. Nutrient loss was not consistently related to fertilizer application. The results of this study are in line with data in the literature which suggest that nutri-

ent discharge is highly dependent upon sediment loss. Water quality of the runoff was also determined. Over 90% of the samples collected exceeded recommended recreational water quality standards for total coliforms and fecal coliforms. Base flows exceeded the same standards 90% of the time for total coliforms and 45% of the time for fecal coliforms. (Small-FRC)
W81-01788

APPROXIMATE METHOD FOR QUICK FLOOD PLAIN MAPPING,
Army Engineer District, Mobile, AL.
R. F. Powell, L. D. James, and D. E. Jones.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 103-122, March, 1980. 11 Fig, 5 Tab, 3 Ref.

Descriptors: *Flood forecasting, *Flood routing, *Flood profiles, Flood data, Flood plains, Mapping, Curves, Mathematical studies, Estimating, *Flood plain mapping.

An approximate method is presented for mapping flood hazard in locations where normal flood hazard mapping has not been completed or would be too expensive. The method is based on normalized curves which can be used with often readily available information on 10 and 25 year floods to estimate large floods. These estimations can be used in flood warning systems or for structural design or regulatory purposes. The results can also be used to verify mapping efforts. If the discharges of two flood frequencies of common occurrence and the shape of the flood frequency curve are known, the information on the two floods can be extrapolated to estimate the discharge for less frequent flood discharges. Annual flood peaks are assumed to follow the log Pearson Type II distribution recommended by the Water Resources Council. The skewness of the data is calculated. Normalized state curves are used which incorporate the effects of the shape and roughness of the flood plain cross sections, stream slope, and other factors that influence the stage-discharge relationship. (Small-FRC)
W81-01837

OPTIMAL CONTROL OF UNSTEADY COMBINED SEWER FLOW,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. W. Labadie, D. M. Morrow, and Y. H. Chen.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 205-223, March, 1980. 8 Fig, 2 Tab, 23 Ref.

Descriptors: *Storm runoff, *Overflow, *Sewers, Computer models, Optimization, Water pollution sources, Runoff forecasting, Routing, Control, *Combined sewers.

Computerized control of stormwater runoff and combined sewer overflows is discussed. Combining realistic unsteady flow routing with optimization techniques for determining operating policies is one of the challenges of the computerized approach. Untreated overflows must be avoided or at least regulated in time to minimize pollution impacts. The Marina branch of the planned North Shores Outfalls Consolidation Project in San Francisco is presented as a case study. Here a fully dynamic, unsteady flow model was included within a deterministic dynamic programming formulation of the control problem. Orthogonal polynomials were used. This system showed significant savings in computer time and computer storage requirements over incremental dynamic programming solutions. The algorithm used rapidly determines improved control policies. This technique may be feasible for actual real time use. (Small-FRC)
W81-01838

MAN OUTMATCHES MATH MODELS FOR FLOOD FREQUENCY,
Pima County Flood Control Districts, Tucson, AZ.
For primary bibliographic entry see Field 2A.
W81-01882

BROOK RECHANNELING DEMANDS INTER-AGENCY COORDINATION,
W. A. Farrell.
Public Works, Vol 111, No 8, p 70-72, August, 1980. 1 Fig.

Descriptors: *Flood control, *Water management(Applied), Flow control, *Channeling, Flooding, *Flood routing, Flood protection, Flood plain zoning, Chutes, Civil engineering, Floodproofing, Watershed management, Connecticut, Trout Brook Channel(CT).

Plans are outlined for the reconstruction of 10,000 feet of Trout Brook Channel, a tributary of the Park River Watershed on the flood plain of the South Branch, located near West Hartford, Connecticut. The adjacent flood plain will accommodate floods which now inundate a sizeable residential area on an average of once/year. The plan involved the cooperation of all three levels of government along with public and private utilities. Cooperation was needed among the State Department of Environmental Protection, Soil Conservation Service of the USDA, State Department of Transportation, engineering firms, metropolitan district commissions, Connecticut natural gas company, Hartford Electric Light Company, Southern New England Telephone Company, and Hartford Cable Television. When completed the project will have cost several millions of dollars and should eliminate the recurring flood damage. (Baker-FRC)
W81-01884

2F. Groundwater

HYDROLOGY AND MODEL STUDY OF THE PROPOSED PROSPERITY RESERVOIR, CENTER CREEK BASIN, SOUTHWESTERN MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
E. J. Harvey, and L. F. Emmett.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A089782, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigation 80-7, June, 1980. 50 p, 16 Fig, 4 Tab, 17 Ref.

Descriptors: *Multiple-purpose reservoirs, *Groundwater, *Model studies, *Karst, *Missouri, Hydrogeology, Limestones, Underground streams, Water wells, Water yield, Mine drainage, Water quality, Water analysis, *Jasper County(MO), Center Creek basin(MO), Oronogo-Duenweg Belt(MO).

A reservoir has been proposed on Center Creek, Jasper County, southwestern Missouri. Groundwater levels in the limestone uplands adjacent to the reservoir will rise when the impoundment is completed. The site is a few miles upstream from the Oronogo-Duenweg belt in the Tri-State zinc district. Grove Creek joins Center Creek downstream from the reservoir separating it from the mining belt. A model study indicates water-level rises varying from about 20 feet near the reservoir to 0.5 to 1.0 foot in the southern part of the Grove Creek drainage basin. A significant rise in the water table adjacent to the reservoir could increase mine-water discharge if Grove Creek is not an effective drain. However, it is probable that Grove Creek is an effective drain, and the higher groundwater levels in the reservoir area will increase ground-water discharge to Grove Creek, and in turn, Center Creek. The increase in ground-water discharge to Grove Creek will have the beneficial effect of diluting mine-water discharge from the Oronogo-Duenweg belt during periods of low flow. (USGS)
W81-01660

SULFATE REDUCTION IN GROUND WATER OF SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-01662

GROUND WATER IN THE THOUSAND OAKS AREA, VENTURA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-01669

CHARACTERISTICS OF THE GROUNDWATER SEEPAGE INTO GREAT SOUTH BAY,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
H. J. Bokuniewicz, and M. J. Zeitlin.
Special Report 35, March 1980. 32 p, 14 Fig, 2 Tab, 22 Ref, Append.

Descriptors: *New York, *Groundwater movement, *Seepage, *Water sources, Pore water, Aquifers, Bays, Subsurface flow, Coastal areas, Discharge movement, Discharge(Water), Freshwater, Hydrography, Saline water-freshwater interfaces, Outflow, *Great South Bay(NY).

The submarine outflow of groundwater across the floor of Great South Bay in New York contributes fresh water to the Bay. The groundwater flow is especially important in Great South Bay for maintaining water quality and for supporting the hard clam industry. This study measures the source directly and is the first study of the submarine outflow into Great South Bay or into any body of coastal water. Preliminary work showed that much of the seepage occurred within 100 meters of the shore. Submarine outflow rates were as high as 150 liters/day per square meter. Outflow near the shore was typically 50 liters/day per square meter and decreased to about 30 liters/day per square meter at a distance of 100 meters offshore. The typical value of the submarine outflow was calculated to be 4.1 x 10 to the 8th power liters per day. This calculation excluded measurements made near Fire Island, but suggests that significant amounts of groundwater may enter the bay far from shore due to sustained upward leakage from deep aquifers. As a result, the calculated value is an underestimate. It was also found that the flow rate tended to vary with coastal flooding and rainfall. The outflow rates are relatively large and should significantly affect the pore water chemistry. (Garrison-Omniplan)
W81-01741

2G. Water In Soils

THE VARIATION OF IN SITU MEASURED SOIL WATER PROPERTIES WITHIN SOIL MAP UNITS,
Department of Agriculture, Ottawa (Ontario). Land Resource Research Inst.
G. C. Topp, W. D. Zebchuk, and J. Dumanski.
Canadian Journal of Soil Science, Vol 60, No 3, p 497-509, August, 1980. 8 Fig, 3 Tab, 10 Ref.

Descriptors: *Hydraulic conductivity, *Soil texture, *Soil water, Adsorption, Soil types, Porosity, Pore water, On-site tests, Cores, Soil profiles, Geographical regions, *Canada, Soil investigations.

The in situ saturated hydraulic conductivities of nine soil units from the Ottawa-Carleton region were recorded, and core samples were taken at each site for laboratory tests to determine desorption water capacity relationships. For the coarse- and fine-textured soils, similar hydraulic conductivities were found, which were higher than those observed for the medium textured soils. However, measurably different desorption curves were found for each of the coarse- and fine-textured soil units examined. Variability of hydraulic conductivity duplicate measurements at the sites was found to be much less than that of the soil unit as a whole. Two separate groups of soil with significantly different hydraulic conductivities were discerned. A third, intermediate group was also recognized which was not significantly different from the other two groups. Desorption curves were studied

in relation to means of identifying proportions of pore space attributable to structural pores or textural pores and differences in pore size distributions. (Geiger-FRC)
W81-01782

MODELING INFILTRATION,
Bidnan Chandra Krishi Viswa Vidyalaya, Kalyani (India). Dept. of Agricultural Engineering.
R. K. Ghosh.
Soil Science, Vol 130, No 6, p 297-302, December, 1980. 1 Fig, 4 Tab, 10 Ref.

Descriptors: *Mathematical models, *Infiltration, *Soil water movement, Model studies, Hydraulic conductivity, Hydrologic properties, Lewis-Kostiakov equation, Philip's equation, Equations.

A model for infiltration, combining the Lewis-Kostiakov equation and Philip's two-term infiltration equation, is proposed: I = (a times t to the b power) + (K sub s times t), where I = total quantity of water infiltrated, a and b are variables, t = time, and K sub s = saturated hydraulic conductivity of the soil. Comparisons with experimental and calculated data show that results agree over a complete range of times and that the equation is especially suited for long periods, for example, 72 hours. (Cassar-FRC)
W81-01847

2H. Lakes

HEAT TRANSFER IN IRRADIATED SHALLOW LAYERS OF WATER,
Purdue Univ., Lafayette, IN. School of Mechanical Engineering.
M. Behnia, and R. Viskanta.
Paper AIAA-80-1519 presented at AIAA 15th Thermophysics Conference, July 14-16, 1980, Snowmass, Colorado. 8 p, 9 Fig, 15 Ref. American Institute of Aeronautics and Astronautics, New York, NY. OWRT B-077-IND(6).

Descriptors: *Heat transfer, *Temperature distribution, *Radiation, Solar radiation, Thermal radiation distribution patterns, Energy transfer, Irradiation, Ponds, *Thermal stratification, Salinity, Shallow water.

The paper reports on an experimental and analytical investigation of temperature structure in a shallow layer of water heated by an external radiation source. Experiments have been performed in a test cell of known bottom reflection characteristics and suitable for optical observations. A shadowgraph and a Mach-Zehnder interferometer were used to visualize and measure the unsteady temperature profile in the water during irradiation. Experimental results obtained show that absorption of radiant energy by the substrate and/or by the water near the bottom results in an unstable situation and that natural convection flow develops. However, with continued heating the flow is suppressed. Analytical results, supported by the data, indicate that the spectral radiation characteristics of the bottom, and the depth of the water have a decisive influence on the temperature distribution.
W81-01697

LAKE KINNERET: CARBON FLOW PATTERNS AND ECOSYSTEM MANAGEMENT,
Isreal Oceanographic and Limnological Research Ltd., Tiberias.
C. Serruya, M. Gophen, and U. Pollingher.
Archiv fur Hydrobiologie, Vol 88, No 3, p 265-302, April, 1980. 14 Fig, 8 Tab, 85 Ref.

Descriptors: *Food webs, *Carbon, *Zooplankton, Phytoplankton, Seasonal, *Ecosystems, Productivity, Fish food organisms, Cycles, Food chains, Lakes, Israel, *Lake Kinneret(Israel).

As part of a series of studies to establish the energy budget of Lake inneret (Israel), different food web strategies were observed and analyzed quantitatively in terms of carbon flow. Over a ten year period, three main patterns of carbon flow were observed: the Peridinium, the nannoplankton, and the nannoplankton-sardine patterns. Carbon inputs of Lake Kinneret were mainly from internal sources. A maximum of 12% of the total carbon input during rainy winters and approximately 4% during summers is carbon channelled toward sedimentation. This factor severely limits the development of benthic fauna. Fifty percent of the total planktic carbon productivity in winter results from zooplankton eating Peridinium. In spring, the nannoplankton-zooplankton foodchain becomes dominant. The lake accumulates organic carbon in the winter-spring, and the resulting reserves are used in summer to cover the high maintenance requirements of the community. A condition of zero net production prevails in summer, which is suboptimum for fish. (Small-FRC)
W81-01777

LIMNOLOGICAL STUDIES ON LAKE PAMVOTIS (IOANNINA), GREECE, I. HYDROCLIMATOLOGY, PHYTOPLANKTON-PERIPHYTON WITH SPECIAL REFERENCE TO THE VALENCY OF SOME MICROORGANISMS FROM SULPHURETA AS BIOINDICATORS,
Athens Univ. (Greece). Inst. of Systematic Botany.
K. Anagnostidis, and A. Economou-Amilli.
Archiv fur Hydrobiologie, Vol 89, No 3, p 313-342, July, 1980. 5 Fig, 2 Tab, 116 Ref.

Descriptors: *Phytoplankton, *Periphyton, Aquatic life, Limnology, Lakes, Water quality, Bioindicators, Greece.

Phytoplankton and periphyton from Lake Pamvotis, Greece, were studied as part of a series of studies on the limnology and water quality of the lake. Lake Pamvotis is located in the northwestern part of Greece, about 1 km from Ioannina. Information is presented on the microflora investigations of Greek lakes, the geomorphology and climate of the Lake Pamvotis area, and a flora analysis of the phytoplankton and periphyton collected during 1967 and 1970. From the samples collected, 292 taxa were identified: 42 bacteria, 83 Cyanophyta, 78 Chlorophyta, 67 Bacillariophyta, 3 Chrysophyta, 9 Euglenophyta, 2 Xanthophyta, 3 Pyrrhophyta, 6 Mycophyta. All taxa found are listed, and their habitat is described. Most of the investigated biotopes were characterized as sulfidic. Forty-six species of sulfur bacteria, iron bacteria, and apochlorotic Cyanophyta were included in the saprobic systems as bioindicators. (Small-FRC)
W81-01789

2J. Erosion and Sedimentation

THE VOLUME OF SAND AND GRAVEL RESOURCES IN THE LOWER BAY OF NEW YORK HARBOR,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
H. J. Bokuniewicz, and C. T. Fray.
Special Report 32, December, 1979. 34 p, 8 Fig, 2 Tab, 20 Ref, Append.

Descriptors: *New York, *Sands, *Gravels, *Harbors, *Sediments, Sediment density probes, Silts, Seismic properties, Mud, Mud-water interfaces, Marine geology, Sedimentation, Hydrogeology, Marine geology, Particle size, Resources.

To guide future exploration and management of submarine sand resources, four types of information were studied in the shallow (<100-foot) stratigraphy of the Lower Bay floor: (1) core and boring logs, (2) seismic reflection profiles, (3) surficial sediment distribution on the floor of the Lower Bay, and (4) the stratigraphy in Long Island, Staten Island, northern New Jersey and the New York Bight. The study was designed to identify potential mining areas so surficial layers were given particular attention. In general, marine sands overlie glacial outwash sands which, in turn, overlie unconsolidated Cretaceous sediments. Along the margins of the Bay, sands are known to rest on fine-grained deposits at depth; the composition of layers underlying the surficial sand deposits in the central and eastern Bay is unknown. Surficial mud deposits are confined primarily in the Rariran and Sandy Hook Bays, and may be as much as 150 feet thick. Sand deposits were identified that have a total volume of 3,429 million cubic yards. Sand and gravel resources for mining are plentiful, but not all of them can be exploited. Submarine mining must coexist with such other uses as shipping, fishing, and recreation; environmental effects must be considered; and not all of the available sand and gravel is of usable quality. Further study is needed to establish acceptable mining zones and regulations. (Garrison-Omniplan)
W81-01740

WAVE INFLUENCES ON RIVER-MOUTH DEPOSITIONAL PROCESS: EXAMPLES FROM AUSTRALIA AND PAPUA NEW GUINEA,
Sydney Univ. (Australia). Dept. of Geography.
For primary bibliographic entry see Field 2L.
W81-01872

2K. Chemical Processes

CHEMICAL AND PHYSICAL CHARACTERISTICS OF PRECIPITATION AT SELECTED SITES IN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. A. Irwin, and R. T. Kirkland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-159949, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-81, 1980. 70 p, 6 Fig, 2 Tab, 36 Ref.

Descriptors: *Chemistry of precipitation, *Precipitation(Atmospheric), *Water quality, Water analysis, *Florida, Data collections, Sampling, Sites, Baseline studies, Specific conductivity, Calcium, Sodium, Clorides, Hydrogen ion concentration, Nitrogen, Phosphorus, Iron, Lead.

Infrequent sampling of precipitation in Florida has been conducted by the U.S. Geological Survey since 1965. A summary of the historical data from 24 sites throughout Florida indicate that the principal ionic composition of atmospheric precipitation samples is calcium-sodium and bicarbonate-chloride with an average specific conductance of 32 micromhos per centimeter at 25 C. Historically, much of the sampling focused on primary nutrients and selected trace elements. Historical data indicate that nitrogen and phosphorus concentrations averaged 1.1 and 0.1 milligrams per liter, respectively. The limited trace metal data indicate that motor-vehicle activity may have a significant impact on local precipitation quality. Lead, for example, was measured in concentrations of as much as 2,400 micrograms per liter in samples collected in a highly populated, commerical area in south Florida. Statistical testing indicated that most major inorganic constituents, primary nutrients, and trace metals were significantly differnet among the sampling sites. The pH data indicated a range of about 5.0 to 7.0, but only limited pH data were collected and analyzed at the historical sites in such a timely manner as to represent pH conditions of the atmospheric precipitation during active rainfall. A critical review of the historical data suggested that while they may reflect local atmospheric quality conditions they likely do not define baseline conditions from a regional perspective. The application of these data were generally limited regarding regional extrapolation due to lack of standardization of sampling techniques, variable methods of sample preservation, nonuniform sampling intervals, variable sample sizes, and different periods of record. (USGS)
W81-01666

2L. Estuaries

ECOLOGY OF SOUTHERN AFRICAN ESTUARIES. PART XI. MNGAZANA: A MANGROVE ESTURARY IN TRANSKEI,
Cape Town Univ. (South Africa). Dept. of Zoology.
G. M. Branch, and J. R. Grindley.
South African Journal of Zoology (Pretoria), Vol

14, No 3, p 149-170, 1979. 16 Fig, 11 Tab, 25 Ref, 2 Append.

Descriptors: *Estuaries, *Estuarine environment, *Africa, *Ecology, *Chemical analysis, Water analysis, Biomass, Physical properties, Bodies of water, Aquatic habitats, Aquatic environment, Balance of nature, Ecosystems, Geographical regions, Climatic zones, Regions, Foreign countries, Ecological distribution, Tropic, Subtropic, Environmental gradient, *Transkei(Africa).

This survey was conducted to provide information to the Transkeian Government relative to its concern of rational conservation/utilization of its coastal areas. Mngazana supports the richest estuarine fauna and flora known in Transkei and some of the best developed mangroves in southern Africa. Invertebrate fauna includes temperate, tropical, and subtropical species. Compared to the fauna of soft substrates, that of rocks has a higher percentage of stenohaline and estuarine forms, and a more restricted distribution. A high percentage of the biomass of invertebrates in soft substrates consists of detritivores, and the biomass is related to the organic content of the substrate. Physical factors, dissolved oxygen, water transparency, salinity, nitrate, nitrite, silicate, total phosphorus, substrate particle size, and percent organic material in the substrate were determined. Nine sampling stations were used. Mangrove mud has the highest organic content and supports the highest biomass, but few species can tolerate the conditions there. Mangroves are probably the major primary producers in the system. Mngazana's features makes its conservation of unquestionably high importance. (Zielinski-IPA)
W81-01744

A MATHEMATICAL MODEL OF THE KOKSOAK RIVER. (MODELE MATHEMATIQUE DE LA RIVIERE KOKSOAK),
Laval Univ. (Quebec). Dept. of Civil Engineering.
Y. Quellet, and Y. Ropars.
Canadian Journal of Civil Engineering, Vol 7, No 3, p 477-491, September, 1980. 16 Fig, 16 Ref. (English Summary).

Descriptors: *Estuaries, *Model studies, *Salinity, Tides, Rivers, Mathematical models, Koksoak River(Canada), Kuuijjuaq River(Canada), *Canada.

An unidimensional mathematical model using the finite differences method has been developed to study the effects on tides and salinity distribution of a reduction of freshwater discharge in an estuary, the Koksoak River, flowing into Ungava Bay, Canada. Although data were not complete or precise enough to make definite conclusions, some general trends were observed in the comparison between simulated canals and the river itself. (Cassar-FRC)
W81-01781

INFLUENCE OF BIOLOGICAL AND PHYSICAL PROCESSES ON DISSOLVED OXYGEN DYNAMICS IN AN ESTUARINE SYSTEM: IMPLICATIONS FOR MEASUREMENT OF COMMUNITY METABOLISM,
Maryland Univ., Cambridge. Center for Estuarine and Environmental Studies.
W. M. Kemp, and W. R. Boynton.
Estuarine and Coastal Marine Science, Vol 11, No 4, p 407-431, October, 1980. 5 Fig, 4 Tab, 73 Ref.

Descriptors: *Dissolved oxygen, *Aquatic ecosystems, *Estuaries, Respiration, Advection, Photosynthesis, *Chesapeake Bay, Biological communities, Diel migration, Diffusion, Fluctuations, Abiotic environment, Diurnal, Nutrients.

The dynamics of dissolved oxygen (DO) were studied in the estuarine ecosystem near Calvert Cliffs, Chesapeake Bay. Community photosynthesis and respiration rates were calculated in several areas of the bay from time course fluctuations of DO in the open water and in bottles and benthic chambers. Measurements of oxygen diffusion across the air/water interface and of the DO levels in the vertical plane of the water column were performed. Horizontal net dispersion of oxygen was measured as the difference. About 50% of the total oxygen flux at deeper stations is due to biological factors, and 50% to physical processes. Mean values of community photosynthesis accounted for 50% of the total inputs to the supply of DO, while community respiration made up 43% of the outflows. Atmospheric gas transfer contributed about 8% of the inputs and 3% of the outputs. Horizontal dispersion was responsible for about 40-50% of the DO changes in either direction. Differences in photosynthesis and respiration between open and closed systems were found on 11 of 16 occasions and were probably due to artificial decoupling of the experimental environment from major routes of nutrient flux. Open water estimates provided more realistic DO patterns. Some specifications are offered for aquatic environments to be used in open-water methods. (Geiger-FRC)
W81-01863

COMPARISON OF METHODS FOR ANALYSIS OF THE TRANSVERSE AND VERTICAL CIRCULATION CONTRIBUTIONS TO THE LONGITUDINAL ADVECTIVE SALT FLUX IN ESTUARIES,
Washington Univ., Seattle. Dept. of Oceanography.
M. Rattray, Jr., and J. G. Dworski.
Estuarine and Coastal Marine Science, Vol 11, No 5, p 515-536, November, 1980. 3 Fig, 6 Tab, 16 Ref.

Descriptors: *Model studies, *Estuaries, *Fluctuations, *Salinity, Mathematical studies, Velocity, Sampling, Water analysis, Circulation, Advection, Movement, Stratification, Profiles, Cross-sections, Gravity.

Three different sampling patterns were used to assess the transverse and vertical variations of parameters in an estuary cross-section. The sampling designs, which were based on the manner in which the total cross-section is broken up into sub-areas, were made up of uniform vertical spacing and proportional transverse spacing in Design I, proportional vertical spacing and uniform horizontal spacing in Design II, and uniform vertical spacing and uniform horizontal spacing in Design III. Three different hypotheses concerning the nature of the distribution were applied mathematically to test the designs. The model was applied to the Southampton Water, an estuary where both the salinity and velocity have important transverse and vertical variations. At Southampton Water, the longitudinal advective salt flux was found to be almost entirely due to the vertical variations in salinity and velocity. These findings were contrary to previous studies, and followed from the effect of gravity on the vertical stratification of both the salinity and velocity distributions. (Geiger-FRC)
W81-01864

SEASONAL VARIATION IN SPECIES COMPOSITION OF RECENTLY SETTLED FOULING COMMUNITIES ALONG AN ENVIRONMENTAL GRADIENT IN THE INDIAN RIVER LAGOON, FLORIDA,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
D. Mook.
Estuarine and Coastal Marine Science, Vol 11, No 5, p 573-581, November, 1980. 4 Fig, 2 Tab, 29 Ref.

Descriptors: *Fouling organisms, *Aquatic animals, *Environmental gradient, Seasonal, *Lagoons, Invertebrates, Mollusks, *Indian River Lagoon(FL), Florida, Crustaceans, Annelids, Distribution patterns.

Fouling organisms were monitored monthly for a year in the Indian River Inlet, Florida, near the Fort Pierce Inlet, where salinity and temperature are relatively constant, and at points on a gradient approaching Vero Beach 16 km distant, where these parameters are more variable. The number of species was highest near the inlet and gradually decreased toward Vero Beach. Near the inlet, colonial species were dominant; further away from the inlet, eurytopic solitary forms prevailed. It is believed that the colonial species are better competitors for available space. (Cassar-FRC)
W81-01870

WAVE INFLUENCES ON RIVER-MOUTH DEPOSITIONAL PROCESS: EXAMPLES FROM AUSTRALIA AND PAPUA NEW GUINEA,
Sydney Univ. (Australia). Dept. of Geography.
L. D. Wright, B. G. Thom, and R. J. Higgins.
Estuarine and Coastal Marine Science, Vol 11, No 3, p 263-277, September, 1980. 8 Fig, 24 Ref.

Descriptors: *Waves(Water), *Sediment transport, *Rivers, Deposition(Sediments), Deltas, Fluvial sediments, *Estuaries, Ocean waves, Surf, Currents(Water), Sand bars, Sedimentary structures, Rip currents, Littoral drift, Turbulence, Tidal effects, Sediment distribution, Sedimentation, Running waters, *Jaba River(New Guinea), Papua(New Guinea), *Shoalhaven River(Australia), Shoals, River flow, Coasts, Australia, New Guinea.

Patterns of sediment transport and deposition were observed at the river-sea interface of the Shoalhaven River, eastern Australian coast, and the Jaba River, Papua New Guinea. Although dissimilar in some ways, both river mouths are strongly influenced by wave processes. The generalities shared by both deltas, which can be attributed to wave action, are as follows: (1) the force of the breaking waves causes abrupt deceleration and lateral spreading of river water, resulting in a broad crescent-shaped bar within 2 channel widths seaward of the outlet, (2) turbid river water remains trapped on either side of the river mouth, (3) broad shoals capped by shoreward migrating swash bars are produced by wave reworking and steep lateral effluent velocity gradients, (4) sand is returned toward the shore, constricting the outlet, which is partially counteracted by friction between effluent and bar, (5) water flows away from the place of maximum deposition, then toward the sea in large-scale rips, which create delta-margin erosion and crescent-shaped embayments flanking the river mouth bulge, (6) estuarine conditions prevail under low and normal river stages, and wave activity helps flood tides transport sands upstream. These characteristics of wave-dominated river mouths are different from those of river mouths dominated by tides or the river flow. (Cassar-FRC)
W81-01872

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF HOLLOW FIBER REVERSE OSMOSIS MEMBRANES,
Albany International Research Co., Dedham, MA.
D. K. Schiffer, C. E. Kramer, R. B. Davis, and M. J. Coplan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-167215, Price codes: A03 in paper copy, A01 in microfiche. Final Report prepared for Office of Water Research and Technology, November, 1980. 32 p, 11 Fig, 7 Tab. OWRT-C-90266-D(No 9531)(1), 14-34-0001-9531.

Descriptors: *Reverse osmosis, *Composite membranes, *Membrane processes, *Desalination processes, Membranes, Semipermeable membranes, Desalination apparatus, Thin films.

Work conducted under this contract is a continuation of the development of a hollow fiber reverse osmosis composite membrane. Five systems (sulfonated polysulfone, piperazine phthalamide, immobilized zirconium, chemically bound tannins, and direct membrane formation) were investigated as replacements for the polyfuran membrane developed during contract 14-34-0001-7551. Sulfonated polysulfone was the most promising and enough membranes were prepared for testing in small module form at OWRT-Roswell. Testing indicates that SPS is a stable membrane with tolerance to

aggressive feeds, such as 50C seawater and pH 8, 100 ppm active chlorine.
W81-01652

SPARGED AIR DISTILLED WATER RECOVERY SYSTEM,
W. A. Rhodes.
U.S. Patent No 4,200,497, 5 p, 2 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1737, April 29, 1980.

Descriptors: *Patents, *Desalination, *Desalination apparatus, Separation techniques, Water purification, Distillation, Condensation, Desalination processes, Bubbles, Jets.

The invention relates to the distillation of water for purification purposes such as desalination and is concerned primarily with such a system in which sparged air is introduced into a body of water close to the surface where it generates bubbles which pass to the surface of the water and entrain vapor to form a mixture of air and water vapor which is conducted to a condenser from which distilled water is drained. The sparged air distilled water recovery system comprises a closed tank having spaced end walls. Passing through one end wall is a conduit that is connected at one end to a source of supply of water under pressure and terminating in a jet nozzle. An overflow drain is mounted in the opposite end wall and maintains substantially constant the level of water in the tank. A closed vapor and air circulating system extends from the end wall having the overflow drain to the end wall in which the jet nozzle is mounted. (Sinha-OEIS)
W81-01712

ION EXCHANGE PROCESS FOR DESALINATION,
Rohm and Haas Co., Philadelphia, PA. (Assignee).
H. Shimizu.
U.S. Patent No 4,202,737, 12 p, 4 Fig, 1 Tab, 5 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 616, May 13, 1980.

Descriptors: *Patents, *Water treatment, *Desalination, Desalination processes, Desalination apparatus, Ion exchange, Resins, Carbonates, *Heat regeneration.

An ion exchange process for desalination is described. A thermally regenerable ion exchange resin having weakly acidic free acid groups and weakly basic free base groups is carbonated, for example by contact with an H2CO3 solution, whereby the free base groups are converted to a carbonate form. The conversion may be effected either prior to or simultaneously with contact between the resin and the solution to be desalinated. Both fixed bed and continuous or semi-continuous resin systems are usable. The process maintains the desalination capacity at a high level while providing effective desalination. (Sinha-OEIS)
W81-01731

DEVELOPMENT OF IMPROVED CLEANING AND SURFACE REGNERATION METHODS AND ECONOMIC ANALYSIS OF THESE METHODS FOR SEAWATER MEMBRANES.
Burns and Roe Industrial Services Corp., Oradell, NJ.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170607, Price codes: A06 in paper copy, A01 in microfiche. Report prepared for Office of Water Research and Technology, January 31, 1981. 104 p, 12 Fig, 14 Tab, 21 Ref, 3 Append. OWRT-C-90183-D(No 9524)(1), 14-34-0001-9524.

Descriptors: *Desalination, *Membrane processes, *Reverse osmosis, Seawater, Thin film composite membranes, Hollow fiber nylon membranes, Membrane regeneration.

Seawater membranes having deteriorated salt rejection through partial loss of the desalting layer are regenerated to approach their initial rejection through the application of chemical agents. The agents include water dispersible resins, surfactants, other colloids and organic acids. The effectiveness of a regenerating agent is a function of (1) type of membrane material; (2) initial level of salt rejection, and (3) flow conditions. At optimum additive concentration, the membrane quality parameter, A super 2/B increases. For an agent to sustain its effect for a long period, it should be capable of some specific interaction with the membrane such as hydrogen bonding. In all cases studied, it is cost effective to clean and regenerate rather than replace modules. However, in some cases, replacement is recommended.
W81-01757

DATA COLLECTION AND ANALYSIS OF COMMERCIAL MEMBRANE DESALINATION PLANTS--VOLUME I--SUMMARY,
DSS Engineers, Inc., Fort Lauderdale, FL.
S. Latour, J. Anderton, and J. Menningmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170573, Price codes: A06 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology, Sept., 1980. 100 p, 15 Fig, 34 Tab. OWRT-C-80130-S(No 8531)(1), 14-34-0001-8531.

Descriptors: *Desalination, *Plant histories, *Electrodialysis, *Reverse osmosis, *Membrane processes, Hollow fibers, Composite R.O. membranes, Cellulose acetate membranes, Brackish water desalting, Operating costs, Raw water pretreatment.

This report is compiled in three volumes: I. Summary, II. Reverse Osmosis Plants; III. Electrodialysis/Electrodialysis Reversal Plants. Twenty-four commerical membrane desalination plants, ranging in size from 12,000 GPD to 5.0 MGD were surveyed including 14 reverse osmosis, 6 electrodialysis-reversal, and 4 standard electrodialysis facilites. Background information is presented on each plant's history and future plans; regarding water demand, feedwater supply, treatment options, and initial procurement. The design of each plant is documented with a piping and instrumentation diagram and an accompanying description of the initial and existing design as regards the feedwater supply, pretreatment, demineralization process, product/brine treatment, and the instrumentation and controls. An in-depth analysis of individual plant's operations and performance addresses major material failures, operating efficiences, and the membrane cleaning systems employed. Normalized production costs are developed from the stated consumption of the consumables used. Operator training and requirements are explained for each of the plants. Recommendations for more efficient operations are also offered.
W81-01758

DATA COLLECTION AND ANALYSIS OF COMMERCIAL MEMBRANE DESALINATION PLANTS--VOLUME II--REVERSE OSMOSIS PLANTS,
DSS Engineers, Inc., Fort Lauderdale, FL.
S. Latour, J. Anderton, and J. Menningmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170581, Price codes: A15 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology, Sept., 1980. 310 p, 118 Fig, 67 Tab. OWRT-C-80130-S(No 8531)(2), 14-34-0001-8531.

Descriptors: *Desalination, *Plant histories, *Reverse osmosis, *Membrane processes, Hollow fibers, Composite R.O. membranes, Cellulose acetate R.O. membranes, Brackish water desalting, Operating costs, Raw water pretreatment.

This report is compiled in three volumes: I. Summary, II. Reverse Osmosis Plants; III. Electrodialysis/Electrodialysis Reversal Plants. Twenty-four commerical membrane desalination plants, ranging in size from 12,000 GPD to 5.0 MGD were surveyed including 14 reverse osmosis, 6 electrodialysis-reversal, and 4 standard electrodialysis facilities. Background information is presented on each plant's history and future plans; regarding water demand, feedwater supply, treatment options, and initial procurement. The design of each plant is documented with a piping and instrumentation diagram and an accompanying description of the initial and existing design as regards the feedwater supply, pretreatment, demineralization process, product/brine treatment, and the instrumentation and controls. An in-depth analysis of individual plant's operation and performance addresses major material failures, operating efficiencies, and the membrane cleaning systems employed. Normalized production costs are developed from the stated consumption of the consumables used. Operator training and requirements are explained for each of the plants. Recommendations for more efficient operations are also offered.
W81-01759

DATA COLLECTION AND ANALYSIS OF COMMERCIAL MEMBRANE DESALINATION PLANTS--VOLUME III--ELECTRODIALYSIS/ ELECTRODIALYSIS REVERSAL PLANTS,
DSS Engineers, Inc., Fort Lauderdale, FL.
S. Latour, J. Anderton, and J. Menningmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170599, Price codes: A12 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology, Sept., 1980. 245 p, 48 Tab, 91 Fig. OWRT-C-80130-S(No 8531)(3), 14-34-0001-8531.

Descriptors: *Desalination, *Plant histories, *Electrodialysis, *Membrane processes, *Ion exchange membranes, Brackish water desalting, Operating costs, Raw water pretreatment.

This report is compiled in three volumes: I. Summary, II. Reverse Osmosis Plants; III. Electrodialysis/Electrodialysis Reversal Plants. Twenty-four commercial membrane desalination plants, ranging in size from 12,000 GPD to 5.0 MGD were surveyed including 14 reverse osmosis, 6 electrodialysis-reversal, and 4 standard electrodialysis facilities. Background information is presented on each plant's history and future plans; regarding water demand, feedwater supply, treatment options, and initial procurement. The design of each plant is documented with a piping and instrumentation diagram and an accompanying description of the initial and existing design as regards the feedwater supply, pretreatment, demineralization process, product/brine treatment, and the instrumentation and controls. An in-depth analysis of individual plant's operations and performance addresses major material failures, operating efficiencies, and the membrane cleaning systems employed. Normalized production costs are developed from the stated consumption of the consumables used. Operator training and requirements are explained for each of the plants. Recommendations for more efficient operations are also offered.
W81-01760

3C. Use Of Water Of Impaired Quality

AQUACULTURE IN SOUTH EAST ASIA: SOME POINTS OF EMPHASIS,
Tamil Nadu Agricultural Univ., Tuticorin (India). Fisheries Coll.
M. N. Kutty.
Aquaculture, Vol 20, No 3, p 159-168, July, 1980. 1 Fig, 1 Tab, 33 Ref.

Descriptors: *Fish farming, *Recycling, *Waste disposal, Eutrophication, Nutrients, Commercial fishing, *Aquiculture, Sewage, Carp, Salmonids, Commercial shellfish, Asia, Food abundance, *India.

Some aspects of aquiculture in Asia are reviewed, with emphasis on the need for increased production of cheaper animal protein. The Eastern cultures have generally been more advanced in the commercial growing of aquatic species. Aquiculture is practiced in developing countries mainly to provide organisms to serve as food and to recycle organic wastes. The priorites of current aquiculture programs, which are supported by many international organizations, are discussed. The use of sewage as a nutrient source in fish culture systems has been practiced in several Asian countries. Controlled eutrophication has given high production rates with caged fish in Indonesian streams, and the

polyculture of carp has been tested in sewage-fed ponds in India. Fish raised on sewage must be examined thoroughly for pathogens before they are deemed fit for human consumption. Semi-cultural conditions of fish growing using oceans and man-made reservoirs may also be profitable. The abiotic factors affecting fish reproduction and growth must be carefully controlled. Behavioral patterns of fish should also be studied to optimize fish growth and prevent wasting of energy derived from food. Other areas of aquiculture that require further research are the genetic improvement of species used for breeding and fish food sources. (Geiger-FRC)
W81-01767

CHIRONOMID FARMING-A MEANS OF RECYCLING FARM MANURE AND POTENTIALLY REDUCING WATER POLLUTION IN HONG KONG,
Chinese Univ. of Hong Kong, Shatin. Dept. of Biology.
For primary bibliographic entry see Field 5G.
W81-01776

LONG-TERM EFFECTS OF IRRIGATION WITH WASTE WATER,
Utah Water Research Lab., Logan.
J. H. Reynolds, M. O. Braun, W. F. Campbell, R. W. Miller, and L. R. Anderson.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 672-687, April, 1980. 5 Fig, 12 Tab, 21 Ref.

Descriptors: *Irrigation water, *Irrigation effects, *Waste water irrigation, Effluents, Irrigation, Alfalfa, Municipal wastes, Coliforms, Heavy metals, On-site investigations, Phosphorus, Soil disposal fields, *Impaired water use.

A 24-month study to determine the long-term effects of applying secondary treated municipal effluent to land is reviewed. Data collected at a site irrigated with waste water effluent since 1957 was compared with data collected at a normal irrigation site. The waste water irrigation site was part of a slow-rate or crop-irrigation land application system. Parameters monitored on a monthly basis included: total coliforms, fecal coliforms, fecal streptococcus, various chemical properties, levels of various metals including heavy metals, and various organic compounds. Soil characteristics and plant characteristics were determined. The secondary treated municipal effluent was of significantly poorer quality than the normal irrigation water, but it was acceptable for crop irrigation. The treated site showed no accumulation of nitrogen, lead, copper, zinc, chromium, or cadmium. There was an increase in available phosphorus at the treated site, but there was no harmful accumulation of heavy metals in alfalfa grown there. There seemed to be no serious harmful effects as a result of long-term irrigation with waste water. (Small-FRC)
W81-01823

WATER REUSE: AN UNFINISHED AGENDA,
C. C. Johnson Associates, Silver Spring, MD.
C. C. Johnson, Jr.
Environmental Science & Technology, Vol 14, No 11, p 1304-1306, November, 1980.

Descriptors: *Water reuse, *Conferences, Groundwater recharge, Public health, Virginia, Water quality, Reclamation, Recharge, Reclaimed water, Potable water, Water purification, Infiltration.

An EPA Symposium on Protocol Development was held in Virginia, July 29-31, 1980 to develop criteria and standards for potable water reuse and non-potable options. The meeting sought to recommend basic principles that could be used in the decision-making process and specify experiments which could be used to help answer the questions that still exist concerning potable water reuse. The symposium was attended by toxicologists, engineers, chemists, groundwater specialists, microbiologists and researchers in the field of non-potable options. Key issues centered around the reuse of water due to shortages in potable supplies and the need for overall protection of public health. Deliberations among the workshop members focussed on formal charges to consider the source of the water, its quality, treatment alternatives, and monitoring needs. Water reuse programs are currently in operation in many foreign nations and on an experimental basis in Virginia. Groundwater recharge programs are essentially water reuse programs. Unplanned reuse occurs when treatment plant intakes exist just downstream of waste water treatment plant discharge sites. Most of the symposium working groups agreed that the problems of potable reuse were not insurmountable, and it could be achieved with updated technology. It was also concluded that more research was needed on the transport of pathogens, metals, and organics in groundwater recharge and other water reuse systems. (Geiger-FRC)
W81-01898

3D. Conservation In Domestic and Municipal Use

REPORT ON WATER LOSSES,
For primary bibliographic entry see Field 5F.
W81-01773

3E. Conservation In Industry

BACKWASH WATER RECYCLING SYSTEM,
PepsiCo., Inc., Purchase, NY. (Assignee).
H. C. De Longe, and W. S. Fabian.
U.S. Patent No 4,202,768, 6 p, 1 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 625, May 13, 1980.

Descriptors: *Patents, *Water treatment, *Industrial water, *Water reuse, Filtration, Water quality control, Recycling, *Backwashing, Holding tanks.

A process and apparatus for the treatment of the aqueous backwash effluent resulting from a backwashing operation of an industrial filter are described. During the backwashing operation, particulate matter and solids are dislodged from the industrial filter so as to be entrained in the backwash effluent, and the effluent is passed through a backwash filter to remove these materials. After passing through the backwash filter, the normally water-based backwash solution is directed to a holding tank for storage until a subsequent backwashing operation is required. The pH value and chlorination level of the backwash solution are periodically adjusted to maintain them within selected ranges in order to optimize the sanitizing effect of the solution during the backwashing operation. The process and apparatus results in the consumption of a much smaller quantity of water than prior arrangements wherein a single use backwash solution is dumped into the general effluent discharge of the plant. (Sinha-OEIS)
W81-01736

3F. Conservation In Agriculture

SELF-PROPELLED IRRIGATION SYSTEM,
E. Stenild.
U.S. Patent No 4,201,343, 6 p, 3 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 146, May 6, 1980.

Descriptors: *Patents, *Irrigation systems, Sprinkler irrigation, *Application equipment, Mechanical equipment, Irrigation operation and maintenance, Irrigation efficiency.

A self-propelled irrigator has a water-driven rotor carrying spray nozzles and a reel driven by the rotor for winding up a rope for moving the irrigator over the ground. The reel is driven by a transmission including a ratchet wheel, the teeth of which are successively hit by an impact member on the rotor. The rotor functions as an energy-accumulating flywheel, and every time the stop member hits a tooth on the ratchet wheel, some of the accumulated rotatory energy is supplied to the power transmission, which drives the reel upon which the rope is wound. Since the free end of the rope is secured to a fixed point, the irrigator is with great force pulled smoothly forward, thereby ensuring uniform irrigation. (Sinha-OEIS)
W81-01720

SHIFTABLE STATOR SPRINKLER HEAD,
Toro Co., Riverside, CA. (Assignee).
L. J. Lichte.
U.S. Patent No 4,201,344, 8 p, 8 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 146, May 6, 1980.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Application equipment, Nozzles, Irrigation operation and maintenance, Irrigation efficiency.

A reversible turbine-driven sprinkler head includes a vaned turbine motor for rotatably driving a nozzle. The turbine is unresponsive to the normal flow of fluid through the sprinkler head to the nozzle. Switchable deflection means are included for deflecting the flow of fluid through the body against the turbine to cause rotation in either of two directions. By deflecting the fluid flow to cause the turbine to rotate in one direction, the nozzle is rotated in one direction. By switching the direction of fluid deflection to cause the turbine to flow in the opposite direction, the nozzle is rotated in the opposite direction. Adjustable means are provided for setting the positions relative to the rotation of the nozzle whereas the deflection of the fluid flow is reversed, whereby the nozzle is caused to repeatably oscillate between a first and a second position. (Sinha-OEIS)
W81-01721

CENTER PIVOT IRRIGATION SYSTEM WITH SLINGER-TYPE SPRINKLER MEANS,
L. F. Knudsen.
U.S. Patent No 4,202,596, 6 p, 7 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 572, May 13, 1980.

Descriptors: *Patents, *Irrigation systems, *Sprinkler irrigation, Application equipment, Irrigation efficiency, Irrigation operation and maintenance.

A mobile irrigation system includes an elongated horizontal water conduit assembly having spaced support structures. One end of the water conduit assembly is connected with a source of water under low pressure and discharge pipes are supported from the assembly at spaced points. They open upwardly and outwardly from the interior of the conduit assembly. Motor driven generally horizontal and centrally apertured discs are journaled from the assembly and the discharge pipes project upwardly through the central apertures in the discs. The upper end portions of the discharge pipes include generally horizontal outwardly opening outlet portions for discharging low pressure water. The disc includes upstanding water slinger vanes spaced from each other for engaging and angularly accelerating the water discharged onto the discs upon rotation of the latter. The outer ends of the vanes are contoured to discharge the accelerated water at high velocity. (Sinha-OEIS)
W81-01729

IRRIGATION-HYDROMETRY (BESPROEIING - WATERMETING),
Department of Agricultural Technical Services, Pretoria (South Africa).
J. W. Badenhorst.
The Citrus and Subtropical Fruit Journal (Johannesburg), No 548, p 6-11, 14-15, 24, July, 1979. 12 Fig, 10 Tab, 4 Ref.

Descriptors: *Flow measurement, *Flow system, *Flowmeters, *Hydrometry, *Irrigation practices, *Agriculture, Instrumentation, Accuracy, Flow rates, Flow characteristics, Flow discharge(Water), Gages, Instrumentation, Orifice flow, Pipe flow, Hydraulics, Measurement, Water properties, Design criteria, Irrigation efficiency, Streamflow, Analysis, Irrigation, Benefits.

Measurement of water flow in irrigation practice is reviewed. Attention is given to the simplest and most inexpensive methods that can be used for the accurate determination of flow rate of water as applied in agriculture. Covered are gravimetric and volumetric methods, the measurement of flow rates in vertical and horizontal pipes, the siphon pipe method, commerically-available hydrometers, and the orifice plate method. Design criteria are provided for the various hydrometry methods, along with seven practical examples (and their solutions) to illustrate the use of the conversion tables provided. (Zielinski-IPA)
W81-01746

SUCCESSFUL MICRO-IRRIGATION IN ZULULAND,
Llanwarne Estates, Zululand (South Africa).
W. Koekemoer.
The Citrus and Subtropical Fruit Journal (Johannesburg), No 549, p 14-15, August, 1979.

Descriptors: *Irrigation practices, *Irrigation efficiency, *Africa, *Irrigation effects, Irrigation design, Crop response, Crop production, Infiltration, Irrigation, Watering, Effects, Farm management, Trees, Fruit crops, Orchards, Plant groupings, Profit, Costs, Economic efficiency, Benefits, Cultivation, Cultivated lands, Mechanical control, Planting management, *Zululand(Africa).

Micro-irrigation is considered an instrument to ensure maximum profit in the cultivation of trees. The first system was installed in 1974. Nineteen advantages of this system (micro-irrigation) over conventional methods of irrigation (flood irrigation and dragline) have been enumerated and discussed. Water and labor savings are made, new plantings come into production sooner, and larger production (easily, 10%) is noted. The method extends tree life (over-irrigation causes root-rot), diminishes appearance of creasing, burst fruit and thick skins, and has low maintenance costs (no moveable parts; uses buried pipes). Other advantages include: erosion prevention; performance of other orchard activities (spraying, fertilizing, picking) during micro-irrigation; facilitated weed control (only the section under the tree gets water); independent of soil structure or ground grade; even blooming; and provides convenient locations of filling points for spray application. Also, fertilizers can be applied through micro-irrigation and windbreaks can be supplied with water from microjets at no real extra cost. Since the tree is supplied with sufficient water continuously, its metabolic process function is undisturbed. (Zielinski-IPA)
W81-01747

SPRING SOIL WATER, PRECIPITATION, AND NITROGEN FERTILIZER: EFFECT ON BARLEY YIELD,
Department of Agriculture, Lethbridge (Alberta). Research Station.
J. B. Bole, and U. J. Pittman.
Canadian Journal of Soil Science, Vol 60, No 3, p 461-469, August, 1980. 2 Fig, 3 Tab, 17 Ref.

Descriptors: *Soil water, *Precipitation, *Nitrogen fertilizer, *Yield equations, *Barley, Crop production, Fertilizers, Rainfall, Model studies, On-site investigations, Irrigation, Mathematical studies, Nitrogen compounds, Water conservation.

A regression model (R=0.94) based on results of a 5-year field study was used to describe barley yield as a function of available soil water in the spring (WS), growing season precipitation (GSP), and N fertilizer. The study was undertaken to synchronize fertilization with optimum soil water conditions in order to minimize the use of irrigation water later on in the growing season. Barley yields on plots with WS and GSP levels within the scope of the data used to derive the equation were similar to yields predicted by the model. WS was based on soil water measured on May 15 or June 1, and GSP was measured for the period extending from June 1 to July 31. When rainfall occurring after July 31 was included in the data, the accuracy of the model sharply decreased. GSP and WS had a similar effect on yield at the GSP levels occurring in the study. However, when the long-term average GSP and WS levels recorded at Lethbridge were used, WS was only about half as effective as GSP on stubble, and one-third as effective on summer fallow. GSP was three times more effective on barley response to N fertilizer than WS. A farmer may use the model to determine optimum rates of N fertilization based on a gravimetrically determined WS level at seeding, with the GSP probability representing risk levels when the current cost: price ratio for N fertilizer and barley are known. (Geiger-FRC)
W81-01783

SPRING SOIL WATER, PRECIPITATION, AND NITROGEN FERTILIZER: EFFECT OF BARLEY GRAIN PROTEIN CONTENT AND NITROGEN YIELD,
Department of Agriculture, Lethbridge (Alberta). Research Station.
J. B. Bole, and U. J. Pittman.
Canadian Journal of Soil Science, Vol 60, No 3, p 471-477, August, 1980. 2 Fig, 2 Tab, 17 Ref.

Descriptors: *Soil water, *Yield equations, *Proteins, Precipitation, *Barley, *Nitrogen yield, Fertilizers, Nitrogen compounds, Irrigation, Mathematical studies, Crop production, Rainfall, Water conservation, Model studies, On-site investigations, Absorption, Nitrogen.

Cereal protein levels are affected by N fertilization and the amount of available moisture. A five year study was undertaken to derive a mathematical expression relating barley protein content and N uptake to stored soil water and precipitation, and to optimize fertilization and planting time to conserve the amount of irrigation water required later on in the growing season. Barley protein content and yield were mathematically described as a function of available soil water before seeding (Ws), growing season precipitation (GSP), and fertilizer N level (N). Ws values were calculated from data derived from fall irrigation practices and from fields prepared by covering plots with polyvinyl chloride sheets to exclude fall and winter precipitation and snowmelts. N rates increased protein content greatly when Ws was low. With 100-180 kilograms N/ha and Ws values of less than 100 mm, protein contents of 15-19% were achieved. If Ws was over 150 mm, then N rates greater than 100 kilograms/ha could be used. When Ws was less than 100 mm, protein content could only be maintained below the maximum level for malting barley by restricting N rates to 20-50 kilograms/ha. Protein content was not affected by GSP levels in this study. Although barley grain N yield ranged from negligible levels to over 100 kilograms/ha, in general the incremental N yield was less than 30% of the rate of N applied during fertilization. (Geiger-FRC)
W81-01784

WATER-USE EFFICIENCY OF TRANSPLANTED AND DIRECT-SOWN RICE UNDER DIFFERENT WATER-MANAGEMENT PRACTICES,
Indian Agricultural Research Inst., New Delhi.
S. B. Hukkeri, and A. K. Sharma.
Indian Journal of Agricultural Sciences, Vol 50, No 3, p 240-243, March, 1980.

Descriptors: *Rice, *Rice transplanting, *Irrigation efficiency, Water management, Irrigation practices, Submergence, Planting management, Water resources, Efficiency, *India, Cereal crops.

Rice was grown on sandy clay loam soils at Delhi, India, during the wet seasons of 1972 and 1973. Transplanting was the most water-efficient method of the 5 planting treatments tried. It produced the largest crop and used less water, 183 cm per year, than the 4 direct sowing methods, 219 to 234 cm per year. Three water management methods were tried. Submergence for almost the entire growth season using 262 cm of water yielded the best crop, but required the most water. The other two methods produced almost as much grain but with greatly reduced water use. The method using intermittent submergence only during critical stages of tillering and flowering used 164 cm of water. The most water efficient practice combined transplanting with minimum submergence. A good alternative method for areas and seasons with ample water resources was the direct seeding with sprouted seeds on puddled soil. (Cassar-FRC)
W81-01867

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

URBAN RUNOFF MANAGEMENT STRATEGIES,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4C.
W81-01658

AQUATIC WEED CUTTER, DE-ROOTER AND HARVESTER,
E. G. Stewart.
U.S. Patent No 4,202,155, 12 p, 6 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 418, May 13, 1980.

Descriptors: *Patents, *Aquatic weeds, *Aquatic weed control, Channel improvement, Equipment, Weed cutters.

An apparatus for cutting, de-rooting and harvesting of aquatic weed growth is disclosed. The apparatus is of modular construction for ease of land transportation and includes a cutting and de-rooting head assembly which is carried by extensible framing for proper positioning on the bed of a river or lake. The head assembly has weed severing means and scribbing, polishing means in the form of vortex generators and may include lake bed scarifying means to assist in de-rooting weed growth. Cut weeds and weed fragments are contained in a vertically extensible curtain containment chamber from which they are loaded into a trailing hopper. The problems of turbidity, cut weed collection and fragment containment are overcome by providing a retractible containment curtain which envelops the working head and frame extender assemblies and leads the cut weeds and fragments to a collecting beltless conveyor and a spill-over fragment trap. (Sinha-OEIS)
W81-01728

INVESTIGATIONS OF SMALL, MAN-MADE IMPOUNDMENTS ON THE HYDROLOGY OF THE LOWER OAK CREEK DRAINAGE AREA, COCONINO AND YAVAPAI COUNTIES, ARIZONA,
Northern Arizona Univ., Flagstaff. Dept. of Geology.
L. D. Agenbroad, D. M. Best, and C. C. Avery.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173775. Technical Report, January, 1981. 68 p, 7 Fig, 4 Tab, 14 Ref, 1 Append. OWRT-A-102-ARIZ(1).

Descriptors: *Drainage area, *Drainage engineering, Drainage wells, *Impoundments, *Flood protection, Floodwater, Groundwater reservoirs, Drainage, Drainage systems, Drainage basins, Drainage effects, Drainage districts, Arizona, Controlled drainage, Civil engineering, Construction equipment, Flow, Drainage density, Drainage water, *Stock water, Hydrology, Impounded waters, Flow system, Engineering structures, Groundwater recharge.

The Lower Oak Creek drainage area in north-central Arizona covers about 240 square miles, and presently contains 93 stock tanks having a potential capacity of almost 230 acre-feet. These tanks recharge the local groundwater and also serve to impede flood pulses that eventually make their way into the Salt River and thus pass through the metropolitan Phoenix area. Anomalous wet month (December-March) precipitation during 1978-1980

resulted in extensive flooding in central Arizona (especially to the south). It was concluded that stock tanks can have a definite effect on diminishing the results of such flooding by allowing for water to be retained and to be slowly seeped into the subsurface. Hence, these tanks play a significant role in the overall groundwater hydrology of the drainage area. Increased construction of such tanks and their appropriate placement in the Oak Creek watershed and surrounding drainage areas could play a key role in minimizing downstream effects of future flooding events. (Zielinski-IPA)
W81-01754

4B. Groundwater Management

DISTRIBUTION OF NITRATE IN THE UNSATURATED ZONE, HIGHLAND-EAST HIGHLANDS AREA, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-01661

POTENTIAL FOR USING THE UPPER COACHELLA VALLEY GROUND-WATER BASIN, CALIFORNIA, FOR STORAGE OF ARTIFICIALLY RECHARGED WATER,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. J. Mallory, L. A. Swain, and S. J. Tyley.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $3.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-599, September, 1980. 23 p, 10 Fig, 14 Ref.

Descriptors: *Artificial recharge, *Groundwater basins, *Water storage, *California, Groundwater resources, Water table, Water quality, Water management(Applied), Evaluation, *Coachella Valley(CA), State Water Project(CA).

This report presents a preliminary evaluation of the geohydrologic factors affecting storage of water by artificial recharge in the upper Coachella Valley, Calif. The ground-water basin of the upper Coachella Valley seems to be geologically suitable for large-scale artificial recharge. A minimum of 900,000 acre-feet of water could probably be stored in the basin without raising basinwide water levels above those that existed in 1945. Preliminary tests indicate that a long-term artificial recharge rate of 5 feet per day may be feasible for spreading grounds in the basin if such factors as sediment and bacterial clogging can be controlled. The California Department of Water Resources, through the Future Water Supply Program, is investigating the use of ground-water basins for storage of State Water Project water in order to help meet maximum annual entitlements to water project contractors. (USGS)
W81-01663

GROUND WATER IN THE THOUSAND OAKS AREA, VENTURA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. J. French.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113235, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-63, August, 1980. 40 p, 12 Fig, 5 Tab, 14 Ref.

Descriptors: *Groundwater, *Groundwater basins, *Water management(Applied), *Urbanization, *California, Groundwater resources, Aquifers, Hydrogeology, Water wells, Water yield, Water levels, Drawdown, Groundwater movement, Water demand, Irrigation, Artificial recharge, Imported water, Water quality, Chemical analysis, Ventura County(CA), Thousand Oaks(CA), Conejo Valley(CA).

The ground-water basin beneath the city of Thousand Oaks, Calif., corresponds closely in area with the surface-water drainage basin of Conejo Valley. Before World War II there was little ground-water development. After World War II, urban development put a stress on the ground-water basin; many wells were drilled and water levels in wells were drawn down as much as 300 feet in places. Beginning in 1963, imported water replaced domestic and municipal ground-water systems, and water levels rapidly recovered to predevelopment levels or nearly so. Most of the ground water in the Thousand Oaks area is stored in fractured basalt of the middle Miocene Conejo Volcanics. Depending on the degree of occurrence of open fractures and cavities in the basalt, recoverable ground water in the upper 300 to 500 feet of aquifer is estimated to be between 400,000 and 600,000 acre-feet. The yield of water from wells in the area ranges from 17 to 1,080 gallons per minute. Most of the groundwater in the eastern part of the valley is high insulfate and has a dissolved-solids concentration greater than 1,000 milligrams per liter. In the western part of the valley the ground-water is mostly of a bicarbonate type, and the dissolved-solids concentration is less than 800 milligrams per liter. In most areas of Conejo Valley, ground-water is a viable resource for irrigation of public lands and recreation areas. (USGS)
W81-01669

HYDROLOGIC ANALYSIS OF THE PROPOSED BADGER-BEAVER CREEKS ARTIFICIAL RECHARGE PROJECT, MORGAN COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 6A.
W81-01670

DUNKIRK: AN EXAMPLE OF WATER RESOURCES OPTIMISATION. (DUNKERQUE: UN EXEMPLE D'OPTIMISATION DES RESSOURCES EN EAU),
Societe Lyonnaise des Eaux et de l'Eclairage (France).
R. Coulomb.
Aqua, No 8, p 23-26, 1980. 3 Fig, 1 Tab. (English Summary).

Descriptors: *Aquifer management, *Recharge ponds, *Groundwater recharge, *Water supply development, Surface waters, Potable water, *Dunkirk(France), Management, Planning, Public utilities, Projections, Mathematical models, Municipal water, Water consumption, Water reuse, Water resources, Water management, Optimization, France.

Sources of the Dunkirk, France, raw water supply have been diversified and expanded by installing 2 basins for recharging of surface water from the Moulle treatment plant. The recharge is programmed by mathematical model as a function of rainfall and different output flows. In addition, water is pumped from the Bourbourg Canal to the original aquifer supply. After 1990, it is planned to take surface water from a canal and store it in a 211 million gallon basin for later treatment and distribution. (Cassar-FRC)
W81-01774

4C. Effects On Water Of Man's Non-Water Activities

URBAN RUNOFF MANAGEMENT STRATEGIES,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
D. F. Kibler, and G. Aron.
Journal of the Technical Councils of ASCE, Proceedings of the American Society of Civil Engineers, Vol 106, No TC1, Proc. Paper 15600, p 1-12, Aug. 1980, 3 Fig, 4 Tab, 22 Ref. OWRT-A-049-PA(2), 14-34-0001-9040.

Descriptors: *Urban runoff, Downstream, *Hydrology, Land use, Watersheds, Abatement, Drainage, Hydrographs, Groundwater recharge, Peak discharge, Mathematical models, *Flow control, *Upstream control, *Runoff abatement, Hydraulic simulation, Hydrologic models.

A dramatic shift has occurred in the control of urban runoff over the past 10 to 15 years. The conventional practice of rapid removal and delivery of urban runoff to downstream areas is being replaced by the newer concept of reduction and detention of urban runoff in upstream source areas. A successful strategy for managing urban runoff must be based on: (1) application of proper hydrologic tools for the analysis of urban runoff under alternative land-use conditions in the watershed; (2) hydrologic and economic evaluation of the performance of alternative runoff abatement measures; and (3) projection of downstream impacts of selected abatement schemes. The purpose of this paper was to review these basic elements in urban runoff management and to comment on future directions in this evolving field.
W81-01658

OBSERVATIONS ON KINEMATIC RESPONSE IN URBAN RUNOFF MODELS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
D. F. Kibler, and G. Aron.
Water Resources Bulletin, Vol 16, No 3, p 444-452, June 1980, 12 Fig, 4 Tab, 6 Ref. OWRT-A-049-PA(3), 14-34-0001-9040.

Descriptors: *Urban runoff, *Model studies, *Storm water, *Hydrographs, Watersheds, Overland flow, Infiltration, Gages, Drainage, Synthetic hydrology, *Kinematic response, Sensitivity analysis, Parameters, Catchment, Hydraulics.

The results of sensitivity analyses conducted on various parameters of the San Francisco Stormwater Model (a version of WREM) and the Penn State Runoff Model in terms of their impact on outflow hydrographs are discussed. The parameters considered within an idealized catchment included: basin shape, impervious fraction, overland roughness and slope; detention depth; infiltration capacity; and hyetograph timing. The results for the hypothetical catchment were extended to the Izzard laboratory surfaces (asphalt, grass, roofing material) as a means of illustrating the need for changes in model structure, as opposed to continued parameter adjustment. The effects of altering the scale of hydraulic representation in the surface runoff and sewer transport calculations were demonstrated for two gaged watersheds in Hamburg, West Germany.
W81-01659

RIVER MANAGEMENT IN THE URBAN ENVIRONMENT,
R. D. Beaumont.
Imiesa (Johannesburg), Vol 4, No 6, p 25, 27, 29, June, 1979. 7 Fig.

Descriptors: *Urban runoff, *Urbanization, *Channel improvement, *Flood plains, *River flow, River regulation, Streamflow, Urban drainage, Runoff, Storm runoff, Community development, Land use, Urban mapping, City planning, Floods, Floodflow, Flow, Flood control, Floodways, Drainage systems, Watershed(Basins).

The effects of urban development on the natural stability of river systems are discussed in connection with increased runoff, channel stability, and the flood plain. Urbanization results in a greater runoff increase for smaller and more common storms than for larger and less frequent ones. In an urban environment, concreting channels and widening of channels enhance channel stability, but urbanization can also reduce groundwater and dry weather flows that adversely affect vegetal cover along river banks. Townships built close to river banks were susceptible to flooding from increased upstreams runoff, which construction would be restricted by current legislation. Legislative aspects covered (1978 Water Amendment Act requires that development plans of certain townships show the 20-year flood line, but not development constraints) and not covered (interrelation between urban upstream catchment development and

downstream flooding). The basic choice between natural/man-made channels is largely dependent on capital/maintenance costs and their benefits/constraints. (Zielinski-IPA)
W81-01748

EVALUATION OF MANGEMENT PRACTICES ON THE BIOLOGICAL AND CHEMICAL CHARACTERISTICS OF STREAMFLOW FROM FORESTED WATERSHEDS,
Pennsylvania State Univ., University Park. School of Forest Resources.
J. A. Lynch, E. S. Corbett, and W. E. Sopper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170524, Price codes: A06 in paper copy, A01 in microfiche. Institute for Research on Land and Water Resources, Pennsylvania State University, Research Project Technical Completion Report, November, 1980, 107 p, 33 Fig, 24 Tab, 50 Ref. OWRT-A-041-PA(1), 14-34-0001-1140.

Descriptors: *Forest watersheds, *Streamflow, *Clearcutting, Herbicides, *Water quality, Vegetation, Analysis, Stress, Nutrients, Turbidity, Sediments, Aquatic life, Ecosystems, Water yield, Peak discharge, Stream gages, Watershed management, Environmental effects, Chemical characteristics, Biological characteristics, Response, Stormflow parameters.

A 106-acre oak-hickory experimental watershed in central Pennsylvania was clearcut in three phases to evaluate the effects of the clearcuts on the physical, chemical, and biological properties of streamflow. Herbicides were used to control the regrowth of vegetation so that groundwater conditions on the clearcuts would be similar for each phase analysis, and also to quantify maximum response and stress factors. The watershed response to these treatments was characterized by measuring changes in streamflow amounts and timing, stormflow parameters, streamwater temperature, nutrient concentrations, turbidity and sediment, and aquatic macroinvertebrate populations. Biologic implications for the aquatic ecosystem are presented on the basis that each aquatic organism has a particular set of environmental conditions and habitat preferences that are optimal for its maintenance.
W81-01763

4D. Watershed Protection

REVEGETATION OF MINED LAND USING WASTE WATER SLUDGE,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
W. E. Sopper, and S. N. Kerr.
Public Works, Vol 111, No 9, p 114-116, September, 1980. 2 Fig.

Descriptors: *Land reclamation, *Strip mines, *Sludge, Land management, *Revegetation, Soil erosion, Reclamation, Agricultural engineering, Spoil banks, Strip mine wastes, Coal mine wastes.

Both liquid and dewatered sludge products were obtained from local treatment plants and spread on strip mine spoil banks in efforts to reclaim the land. Dewatered sludge was applied with farm manure spreaders at a rate of 40 and 82 dry tons per acre. Immediately after sludge application and incorporation, the site was broadcast seeded with a mixture of two grasses and two legumes. The seeding mixture was Kentucky-31 tall fescue, Pennlate orchardgrass, Penngift crownvetch and Empire Birdsfoot trefoil. The two grass species will germinate quickly and provide a complete protective cover the first year, allowing time for the two legume species to become established and develop into the final vegetative cover. Results of a subsequent monitoring program demonstrated that no harmful effects had occurred as a result of applying the sludge to the ground in the land reclamation project. Even after the third year there was no apparent deterioration of the vegetative cover in any of the sludge-treated areas. Two additional examples of the use of sludge for starting vegetative covers in land reclamation efforts are noted. (Baker-FRC)
W81-01885

REVEGETATION PROJECT UTILIZES SLUDGE,
Colorado School of Mines, Golden.
B. Farquhar.
Public Works, Vol 111, No 7, p 67-68, July, 1980. 2 Fig.

Descriptors: *Land reclamation, *Mining, *Sludge, Land management, Soil erosion, Reclamation, Agricultural engineering, *Revegetation, Colorado.

The AMAX Urad Mine project in central Colorado, a land reclamation project based on the use of sludge for revegetation, is described. The Urad Molybdenum Mine is located near the foot of Berthoud Pass and US Highway 40 and was closed in 1974 after producing 48 million pounds of molybdenum concentrate and 14 million tons of ore. The problem of revegetation of the mill tailings waste product was solved by using three other waste products - rock waste from a nearby mine, waste water treatment plant sludge, and wood chips. The rock mulch provided an ideal mulch. The wood chips bound much of the nitrogen, bringing the levels down to acceptable ones for young plants. The wood also fixes the nitrogen in the humus for future plant use. The site was provided with 20 tons per acre each of sludge and wood chips, followed by an additional 10 tons of sludge per acre three years later. The use of inorganic fertilizers will maintain the vegetation permanently. The Urad reclamation project will cost between 6 and 7 million dollars when completed. (Baker-FRC)
W81-01886

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

SALMONELLA SURVIVAL IN FRESHWATER AND EXPERIMENTAL INFECTIONS IN GOLDFISH (CRASSUIS AURATUS),
Purdue Univ., Lafayette, IN. Dept. of Microbiology, Pathology and Public Health.
R. L. Lawton, and E. V. Morse.
Journal of Environmental Science and Health, Vol A15, No 4, p 339-358, 1980. 5 Tab, 16 Ref. OWRT B-076-IND(7).

Descriptors: *Salmonella, *Aerobic bacteria, *Sewage bacteria, Pollution, Fish diseases, Infection, Bottom sediments, Bacteria, Physiological ecology, *Pollutant identification.

The infection rates for various Salmonella serotypes in goldfish (Crassuis auratus) were evaluated under a number of controlled environmental conditions. Studies were undertaken to determine the number of salmonellae necessary to cause infection, and to elucidate the conditions instrumental to the continued persistence of the pathogen in the aquatic environment. All of 32 strains (representing 12 serotypes of Salmonella) studied infected goldfish. Under appropriate physiological conditions, the fish were infected for a period of two weeks with less than or equal to 5 organisms/ml water. Physiological stress to the fish augmented infection rates. Increased eutrophy, with agitation of the water, was correlated with lowered infection rates and decreased survival of the pathogen. The presence of a bottom sediment under these same eutrophic conditions resulted in infections of six weeks duration. Repeated isolation of salmonellae from the gastrointestinal tracts of the fish suggested that colonization had occurred. A cycle of reinfection, i.e. fish to water to fish, may have taken place. Thus the fish may have contributed an important element for the persistence of Salmonella in freshwater. Salmonella may be used as monitors of fecal pollution in the aquatic biosphere. These bacteria, when present in native fishes may also be retrospective indices of fecal pollution. The presence of Salmonella in any body of water raises serious questions as to water quality and safety for both man and livestock.
W81-01655

EFFECTS OF RESIDENCE IN FISHES UPON THE PATHOGENICITY OF SALMONELLA SEROTYPES FOR LABORATORY WHITE MICE,
Purdue Univ., Lafayette, IN. Dept. of Microbiology, Pathology and Public Health.
E. V. Morse, K. A. Gossett, and M. A. Duncan.
Journal of Environmental Science and Health, Vol A15, No 4, p 359-371, 1980. 4 Tab, 16 Ref. OWRT B-076-IND(6).

Descriptors: *Salmonella, *Aerobic bacteria, *Water pollution, Pathogenicity, Fish diseases, Infection, Laboratory tests, White mice, Analytical techniques, Cultures.

Increasing evidence indicates that freshwater fishes may be naturally and experimentally infected with Salmonella and may harbor the pathogen for more than 100 days. The effects upon the pathogenicity of various serotypes for white mice following residence in freshwater fishes was evaluated. Virulence patterns of serotypes cultured from fish were compared with the same serotypes cultured from man and lower animals. LD sub 50 and ID sub 50 values for the respective isolates were ascertained following intraperitoneal injection of mice. With the exception of 1 strain of S. typhimurium, var. Copenhagen (a smooth (S) phase culture, which rapidly mutated to the rough (R) state) there was no evidence of attenuation or loss of virulence of the serotypes. Results of the study indicate that residence or colonization in poikilotherms has no marked effect on pathogenicity for homoeiothermic hosts.
W81-01657

DISTRIBUTION OF NITRATE IN THE UNSATURATED ZONE, HIGHLAND-EAST HIGHLANDS AREA, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. M. Klein, and W. L. Bradford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-117004, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-48, September, 1980. 70 p, 20 Fig, 16 Tab, 100 Ref.

Descriptors: *Nitrates, *Groundwater, *Artificial recharge, *Aquifer management, *California, Nitrogen, Ion exchange, Irrigation effects, Water pollution sources, Water pollution control, Water quality, Chemical analysis, *San Bernardino County(CA).

In the vicinity of Highland-East Highlands, San Bernardino County, Calif., plans to recharge local aquifers with imported water would raise the water table and intercept nitrogen in the unsaturated zone. Samples from 13 test holes were analyzed to ascertain the distribution of nitrate and related inorganic nitrogen species and other water-quality characteristics. Test holes were ranked according to maximum NO3(-)-N in the top 10 feet, total NO3(-)-N in the top 10 feet, and total NO3(-)-N in the top 40 feet. In all three rankings, the top seven test holes were the same--five in or near past or present agricultural areas (primarily citrus groves), one in a feedlot, and one adjacent to an abandoned sewage-treatment plant. Two test holes in uninhabited areas ranked lowest. The control test hole ranked high in geometric mean ammonium nitrogen, suggesting that NH4(+)-N is present in freshly weathered granite. The geometric mean NH4(+)-N concentrations in six of eight test holes in citrus-related areas were significantly lower than in the control hole. High NO3(-)-N concentrations tended to be found with high specific conductance and chloride concentrations. If recharge is carried out as planned, assuming complete mixing of the recharge water and interstitial pore water in the top 20 feet of the saturated zone, NO3(-)-N concentrations in water at the top of the saturated

zone may exceed 10 milligrams per liter in seven areas studied. (USGS)
W81-01661

SULFATE REDUCTION IN GROUND WATER OF SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
W. S. Dockins, G. J. Olson, G. A. McFeters, S. C. Turbak, and R. W. Lee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-221971, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-9, February, 1980. 13 p, 3 Fig, 2 Tab, 16 Ref.

Descriptors: *Sulfur bacteria, *Groundwater, *Anaerobic bacteria, *Geochemistry, Montana, Analytical techniques, Stable isotopes, Sampling, Sites, Hydrologic data, *Southeastern Montana, Northern Powder River basin(MT), *Sulfate-reducing bacteria.

Ground waters in southeastern Montana were investigated to determine if sulfide production was bacterially mediated. Sulfate-reducing bacteria were detected in 25 of 26 groundwater samples in numbers ranging from 20 to greater than 24,000 bacteria per 100 milliliters for those samples containing bacteria. Stable sulfur isotope fractionation studies indicate a biological role in sulfate reduction. However, sulfate-reducing activity as determined by use of a radioactive sulfur isotope was observed in only 1 of 16 samples. Bacterial dissimilatory sulfate reduction is postulated to be responsible for a major part of the sulfide produced in these ground waters. These bacteria are most likely active in the adsorbed state, possibly in subsurface microzones where environmental conditions are conducive to sulfate reduction. (USGS)
W81-01662

INVESTIGATION OF ACIDITY AND OTHER WATER-QUALITY CHARACTERISTICS OF UPPER OYSTER CREEK, OCEAN COUNTY, NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-01665

WATER QUALITY OF THE NEUSE RIVER, NORTH CAROLINA--VARIABILITY, POLLUTION LOADS, AND LONG-TERM TRENDS,
Geological Survey, Raleigh, NC. Water Resources Div.
D. A. Harned.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-222896, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-36, 1980. 88 p, 34 Fig, 15 Tab, 33 Ref.

Descriptors: *Water quality, *River basins, *Water pollution, *North Carolina, Water pollution effects, Water analysis, Regression analysis, Dissolved oxygen, Dissolved solids, Specific conductivity, Trace elements, Nutrients, Coliforms, Phytoplankton, Coastal Plains, Neuse River(NC).

A water-quality study of the Neuse River, N.C., based on data collected during 1956-77 at the U.S. Geological Survey stations at Clayton and Kinston, employs statistical trend analysis techniques that provide a framework for river quality assessment. Overall, water-quality of the Neuse River is satisfactory for most uses. At Clayton, fecal coliform bacteria and nutrient levels are high, but algae and total-organic-carbon data indicate water-quality improvement in recent years, due probably to a new wastewater treatment plant located downstream from Raleigh, N.C. Pollution was determined by subtracting estimated natural loads of constituents from measured total loads. Pollution makes up approximately 50% of the total dissolved material transported by the Neuse. Two different data transformation methods allowed trends to be identified in constituent concentrations. The methods recomputed the concentrations as if they were determined at a constant discharge over the period of record. Although little change since 1956 can be seen in most constituents, large changes in some constituents, such as increases in potassium and sulfate, indicate that the water quality of the Neuse River has noticeably deteriorated. Increases in sulfate are probably largely due to increased long-term inputs of sulfur compounds from airborne pollutants. (USGS)
W81-01668

PREDICTING SAFE CONCENTRATIONS OF VOLATILE ORGANIC SUBSTANCES IN DISCHARGES TO SEWERS,
Water Pollution Research Lab., Stevenage (England).
B. J. Borne, and J. A. Hobson.
Progress in Water Technology, Vol 12, No 3, p 77-82, 1980. 3 Tab, 1 Ref.

Descriptors: Sewage, *Vapor pressure, *Toxicity, Volatility, Laboratory tests, *Sewers, Threshold limit value, United Kingdom, *Safety factors, Working conditions.

It is necessary to relate the threshold limit value of materials in a sewer atmosphere to the concentration of volatile material in sewage. A scientific basis for predicting maximum allowable concentrations in sewage which makes use of vapor-pressure data and limiting activity coefficients is presented. Vapor pressures and limiting activity coefficients were determined in pure water for a range of volatile compounds of interest to water authorities. The limiting activity coefficients were determined for some of these compounds in crude and settled sewage. A transpiration method was used to measure the ratio between the vapor pressures of the pure substance and of a low molar concentration of the substance in solution, and the limiting activity coefficient was calculated. Values determined are presented for various organic substances, including toluene, chloroform, benzene, etc. The concept of relative atmospheric toxicity is discussed. (Small-FRC)
W81-01689

SELECTIVE PREDATION BY MYSIDS INLAKE RESTORATION BY BIOMANIPULATION,
Washington Univ., Seattle. Dept. of Zoology.
W. T. Edmondson, and P. Murtaugh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170359, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, September 30, 1980. 28 p, 8 Fig, 4 Tab, 29 Ref. OWRT-A-096-WASH(1), 14-34-0001-9051.

Descriptors: *Lake restoration, *Ecosystems, *Predation, *Lake Washington(WA), *Daphnia, Electivity, Gut contents, Mysid, *Neomysis, Predation, Size selection, Zooplankton, Biomanipulation, Bioassy.

After decades of scarcity or absence, members of the crustacean genus Daphnia have become very abundant in Lake Washington in recent years. One hypothesis to explain the recent success of Daphnia is a decline in the abundance of the predatory crustacean Neomysis mercedis, apparently caused by changes in fish predation. This study focuses on the selection of prey by Neomysis and its relevance to the Lake Washington zooplankton community. In feeding experiments in small containers, clearance rates of Neomysis on Daphnia were roughly two to four times higher than those on the copepond Diaptomus. The 'preference' for Daphnia deduced by comparing gut contents to prey densities in the plankton is much more pronounced, and the cladocerans is consistently selected over all other prey species found in the lake. Small mysids select the smallest Daphnia available, but adult mysids can consume cladocerans as large as 3.0 mm. The pattern of electivity over the manageable size range of prey is variable for large Neomysis, suggesting that mysids may alter their feeding behavior in response to changing availability of prey. Since mysids reproduce seasonally in Lake Washington, their size-frequency distribution is alternately dominated by large and small individuals. Size-related differences in feeding rate and prey selection by the mysids therefore imply that the intensity and character of predation on Daphnia will very seasonally as well.
W81-01696

APPLICATION OF AN EVAPORATIVE LOSS MODEL TO ESTIMATE THE PERSISTENCE OF CONTAMINANTS IN LENTIC ENVIRONMENTS,
Purdue Univ., Lafayette, IN. Dept. of Forestry and Natural Resources.
A. Spacie, J. L. Hamelink, and R. C. Waybrant.
In: Special Technical Publication 634, American Society for Testing Materials, Philadelphia, PA. p 214-227, 1977, 4 Fig, 3 Tab, 19 Ref. OWRT-A-017-IND(5).

Descriptors: *Water analysis, *Toxicology, *Evaporative loss model, Persistence, *Aquatic environment, Ecosystems, Nonionic chemicals, *Lentic environment, Pollutants, Synthetic chemicals, Thermal stratification.

A simple, two-layer model for predicting evaporative losses of nonionic synthetic chemicals from water is presented. Losses from well-stirred small vessels are predicted accurately. Losses from thermally stratified bodies of water were poorly predicted because turbulent mixing processes at the interfaces were retarded.
W81-01698

DETAILED SURFACE WATER QUALITY DATA, SASKATCHEWAN, 1974-1976.
Saskatchewan Dept. of the Environment, Regina. Inland Waters Directorate.
Cat. No EN 36-430/6, ISBN 0-662-50706-1, Minister of Supply and Services Canada. 1980. 339 p, 1 Fig, 330 Tab.

Descriptors: *Surface waters, *Water quality, *Canada, *Baseline studies, *Water analysis, Water properties, Data collections, Rivers, Drainage systems, Drainage water, Freshwater, Running waters, Water resources, Biochemical oxygen demand, Nutrients, Cations, Anions, Trace elements, Organic wastes, Industrial wastes, Water pollution, Solid wastes, Pollutants, Turbidity, Water chemistry, Monitoring, Information exchange, Documentation, Phenols, Hydrogen ion concentrations, *Saskatchewan.

Chemical, physical, and biological surface water data for Saskatchewan, collected during the period 1974 to 1976, are reported. These data are intended to provide a ready reference to the water quality variables that were measured. The data were obtained from a number of Water Quality Branch programs. Included in the measured parameters were: water temperature, specific conductivity, pH, turbidity, apparent color, dissolved oxygen, total/fecal coliforms, chlorophyll a, BOD, total hardness, total dissolved solids, total alkalinity, inorganics (biocarbonate, sulfate, Ca, Mg, Na, K, Cl, F, P, B, Al, V, Cr, Mn, Fe, Cu, Zn, Se, Ag, As, Cd, Ba, Hg, Pb), cyanide, total nitrogen, nitrogen oxides, reactive silica, total organic/inorganic carbon, nitrilotriacetic acid, phenolics, n-alkanes, aromatic hydrocarbons, oil/grease, surfactants and pesticides (up to over 20, including PCB's). Analytical methods used for measurement of parameters are given in six-digit codes with the data. This baseline information supports work for assessing trends in the aquatic environment and impacts of development. This report is the first in a series of detailed water quality data reports to be published on a biennial basis. Earlier data for Saskatchewan were summarized in, 'Water Quality Data, Saskatchewan, 1961-1973'. (Zielinski-IPA)
W81-01702

DETAILED SURFACE WATER QUALITY DATA, ALBERTA, 1974-1976.
Inland Waters Directorate, Calgary (Alberta).
Cat. No EN 36-430/3, ISBN 0-662-50690-1, Minister of Supply and Services Canada. 1980. 440 p, 1 Fig, 393 Tab.

Descriptors: *Surface waters, *Water quality, *Canada, *Baseline studies, *Water analysis, Water properties, Data collections, Rivers, Drainage systems, Drainage water, Freshwater, Running waters, Water resources, Biochemical oxygen demand, Nutrients, Cations, Anions, Trace elements, Organic wastes, Industrial wastes, Water pollution, Solid wastes, Pollutants, Turbidity, Water chemistry, Monitoring, Information exchange, Documentation, Phenols, Hydrogen ion concentration, *Alberta.

Chemical, physical, and biological surface water data for Alberta, collected during the period 1974 to 1976, are reported. These data are intended to provide a ready reference to the water quality variables that were measured. The data were obtained from a number of Water Quality Branch programs. Included in the measured parameters were: water temperature, specific conductivity, pH, turbidity, apparent color, dissolved oxygen, total/fecal coliforms, chlorophyll a, BOD, total hardness, total dissolved solids, total alkalinity, inorganics (biocarbonate, sulfate, Ca, Mg, Na, K, Cl, F, P, B, Al, V, Cr, Mn, Fe, Cu, Zn, Se, Ag, As, Cd, Ba, Hg, Pb), cyanide, total nitrogen, nitrogen oxides reactive silica, total organic/inorganic carbon, nitrilotriacetic acid, phenolics, n-alkanes, aromatic hydrocarbons, oil/grease, surfactants, and pesticides (up to over 20, including PCB's). Analytical methods used for measurement of parameters are given in six-digit codes with the data. This baseline information supports work for assessing trends in the aquatic environment and impacts of development. This report is the first in a series of detailed water quality data reports to be published on a biennial basis. Earlier data for Alberta were summarized in, 'Water Quality Data, Alberta, 1961-1973'. (Zielinski-IPA)
W81-01703

PESTICIDES IN THE RIVERS OF THE KRUGER NATIONAL PARK (PLAAGDODERS IN RIVIERWATER VAN DIE NASIONALE KRUGERWILDTUIN),
Plant Protection Research Inst., Pretoria (South Africa).
L. P. Van Dyk.
Koedoe (Pretoria), No 21, p 77-80, 1978. 1 Tab, 3 Ref.

Descriptors: *Pesticide residues, *Sampling, *Water analysis, *Pesticides, *Pesticide detection, Kruger National Park, *South Africa, Rivers, River pollution, Pollution effects, Endosulfan, Dieldrin, DDT, Chlorinated hydrocarbons.

Rivers flowing into the Kruger National Park were monitored for pesticide residues. Altogether, 657 samples were taken from sites located on the Levubu, Letaba, Olifants, Sabie and Crocodile Rivers, These samples were analyzed over a period of two years and in only 11, or two percent, were pesticide residues found. Endosulfan was found in seven samples at concentrations ranging from 100 to 6300 nanogram per cubic decimeter. Dieldrin was found in two samples at concentrations of 1700 and 2000 nanogram per cubic decimeter, while DDT was found in the other two samples at concentrations of 100 and 500 nanogram per cubic decimeter. In 85 samples, or 13%, unkown chlorinated compounds were found, possibly industrial pollutants. The results of this survey indicated that pesticides in rivers do not pose a serious threat to wildlife in the Kruger National Park. (Stiles-IPA)
W81-01745

WASTE WATER SPRAY TRANSPORT IN LAND APPLICATION,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
P. C. Reist, N. J. Zimmerman, A. G. Turner, D. E. Francisco, and P. Robinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170540, Price codes: A10 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina, Raleigh, Report No 152, Dec., 1980. 208 p, 23 Fig, 24 Tab. OWRT-B-104-NC(2), 14-34-0001-7176.

Descriptors: *Land application, *Waste water irrigation, Spraying, Aerosols, Tracking techniques, Tagging, Fluorescent dye, Public health, Bacteria, *Spray irrigation, *Pollutant identification, Path of pollutants, E. coli.

The objective of this study of waste water spray transport from land treatment was to generate a model to predict aerosolized viable particle dispersion from a spray system, taking into account the effects of particle size, microorganism viability and meteorological parameters such as solar radiation, relative humidity, temperature, wind speed and wind direction. Two spray solutions, one containing a viable atmospheric tracer, the bacteria E. coli, and the other a non-decaying tracer, the fluorescent dye, uranine, were simultaneously sprayed in an open field to simulate the aerosolized portion of a full-scale irrigation spray. Ambient concentrations were determined by sampling at distances up to 311 meters downwind. Maximum downwind concentrations were estimated from the dye field data for 65 experimental runs. These data combined with monitored meteorological data were analyzed for development of an appropriate atmospheric dispersion model. Viability of the airborne E. coli was determined from comparisons of the bacteria to dye ratios in the spray and in the samplers. Evaluation of typical waste water disposal operations with the emprical model and assumptions about waste water characteristics and spray equipment aerosolization efficiency indicate low levels of pathogens on the order of one per cubic meter expected thirty meters downwind from sprayed unchlorinated secondary waste water effluent or settled raw waste water depending on specific waste water properites.
W81-01761

QUANTITATIVE STUDIES ON A HUMAN PATHOGEN (CANDIDA ALBICANS) AND TRADITIONAL BACTERIAL INDICATORS OF POLLUTION IN DOMESTIC WASTE WATERS AND RECEIVING WATERS,
Connecticut Univ., Storrs. Inst. of Water Resources.
J. D. Buck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170516, Price codes: A02 in paper copy, A01 in microfiche. Research Project Technical Completion Report, 1980. 10 p, 2 Fig, 1 Tab, 4 Ref. OWRT A-085-CONN(2), 14-34-0001-0107.

Descriptors: *Sewage treatment, Indicators, Chlorine, *Sewage bacteria, *Coliforms, Candida albicans, Survival, *Human pathology, *Bioindicators, Bacteria, Water supply, Pollutant identification.

Significant ($p = 0.01$) positive correlations were found between four indicators of sanitary water quality (Total coliforms, fecal coliforms, fecal streptococci, and Pseudomonas aeruginosa) and the human and animal associated pathogenic yeast Candida albicans in samples taken from five waste water treatment plants over a 12 month period. No correlations were found among these indicators in contiguous receiving waters and sediments due to the low number of organisms present. Survival studies using C. albicans were conducted both in the laboratory and in the field. Fieldwork was done using plexiglas chambers. One study showed that survival was shorter in seawater and longer in distilled water, river water, and filtered raw sewage. A second study considered the effects of chlorine on C. albicans. Higher chlorine concentrations, longer exposure times, and lower pH were found to be deleterious to the survival of C. albicans. The results of this study support the potential of C. albicans for possible application as an indicator of sanitary water quality.
W81-01762

ANALYSIS OF TRACE LEVELS OF VOLATILE ORGANIC CONTAMINANTS IN MUNICIPAL DRINKING WATER BY GLASS CAPILLARY GAS CHROMATOGRAPHY USING SIMULTANEOUS FLAME IONIZATION AND ELECTRON CAPTURE DETECTION,
New Orleans Univ., LA. Center for Bio-Organic Studies.
L. V. McCarthy, E. B. Overton, C. K. Raschke, and J. L. Laseter.
Analytical Letters, Vol 13, No A16, p 1417-1429, 1980. 2 Fig, 1 Tab, 21 Ref.

Descriptors: *Halogenated organic compounds, *Organic compounds, *Potable water, *Water analysis, Volatile organic compounds, Analytical techniques, Gas chromatography, *Pollutant identification.

A rapid (40 minute) method for determining trace volatile organic compounds in drinking water used glass capillary gas chromatography with simultaneous flame ionization and electron capture detection. Both halogenated compounds and hydrocarbons were detected simultaneously at less than a microgram per liter for a 5 ml water sample. Some compounds not detected by flame ionization were identified by electron capture detection and vice versa. Purified diethyl ether was used as a solvent in preparing standard solutions. Solution A, which contained 13 organic compounds common in chlorinated water, was used to illustrate the system's resolution capabilities. Solution B, which contained benzene, toluene, and trihalomethanes, was used for quantitative calibrations and reproducibility studies. The coefficient of variance for 6 compounds (benzene, toluene, and trihalomethanes) was 80% or better in 20 replicate analyses. (Cassar-FRC)
W81-01768

COMBINED MEMBRANE FILTRATION-ELECTROCHEMICAL MICROBIAL DETECTION METHOD,
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
J. R. Wilkins, D. C. Grana, and S. S. Fox.
Applied and Environmental Microbiology, Vol 40, No 4, p 852-853, October, 1980. 3 Fig, 1 Ref.

Descriptors: *Microbiology, *Membranes, *Filtration, Water analysis, Microorganisms, E. coli, Analytical techniques, *Pollutant identification, Coliforms.

E. coli were concentrated by membrane filtration and counted by platinum electrode detection. Bacteria were determined in 100 ml samples of undiluted estuarine and fresh water as well as in water diluted ten-fold and 100-fold. E. coli results compared favorably with previously estimated data in which platinum electrodes were tested in a broth-test tube setup. S. aureus produced erratic results. This combined technique may be a rapid and effective method for estimating microbial loading of water samples. (Cassar-FRC)
W81-01769

AUTOMATIC WATER QUALITY ANALYZERS FOR WASTE WATER COLLECTION AND TREATMENT,
Public Works Research Inst., Ibaraki (Japan).
K. Murakami.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 938-942, May, 1980.

Descriptors: *Monitoring, *Water quality, *Instrumentation, *Toxins, Analytical techniques, Chromium, Cadmium, Copper, Waste water treatment, Cyanide, Selective ion electrodes, *Japan.

By June, 1981, Japanese waste water treatment plants are required to use automatic analyzers for continuous monitoring and recording of organic loadings from treatment plants. Reliable automatic analyzers are needed to monitor hazardous substances, and work on several analyzers still in the developmental stages is summarized. A total cyanide analyzer is being developed which measures cyanide with a cyanide-selective ion electrode after removal of sulfur ions. A total chromium analyzer is a batch type model which uses an automatic background correction mechanism comprising a system of pre-oxidation by aeration before the addition of potassium permanganate. A hexavalent chromium analyzer using the ultraviolet absorption measurement method is under development. The cadmium analyzer uses cadmium ion-

selective electrodes as detection units. The bathocuproine method for cuprous ion analysis is used by the copper analyzer. Analyzers for organic substances are also under development. (Small-FRC)
W81-01798

RECENT CONCEPTS AND DEVELOPMENT OF AN AUTOMATED BIOLOGICAL MONITORING SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
D. Gruber, J. Cairns, Jr., K. L. Dickson, A. C. Hendricks, and W. R. Miller, III.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 465-471, March, 1980. 7 Fig, 18 Ref.

Descriptors: *Monitoring, *Fish, *Ventilation, Model studies, *Bioindicators, *Water quality, Sodium compounds, Chlorine, Ventilatory frequencies, Breathing rate.

The possibility of using fish breathing behavior coupled with chemical/physical monitoring to monitor water quality is discussed. An apparatus is described containing 24 monitor tanks of bluegill. The system was first tested with 5 mg/liter sodium hypochlorite solution; the second test exposed fish to Arbitrary Reference Mixture, a standard developed for the petroleum industry. Chlorinated tap water was also used as a test solution. The primary response of the ventilatory behavior of bluegill to a strong solution of sodium hypochlorite was a significant decrease in the strength of the signals. Coughing also increased. The ventilatory response of fish exposed to ARM was similar. There was an initial decrease in ventilatory frequencies upon exposure to chlorinated tap water. These preliminary results indicate that biological monitoring is a feasible concept. An adequate statistical package capable of detecting abnormal breathing rates is needed. (Small-FRC)
W81-01844

STUDIES ON THE TOXICITY OF PULP AND PAPER MILL EFFLUENTS-I. MUTAGENICITY OF THE SEDIMENT SAMPLES DERIVED FROM KRAFT PAPER MILLS,
Shizuoka Coll. of Pharmaceutical Sciences (Japan).
N. Kinae, T. Hashizume, T. Makita, I. Tomita, and I. Kimura.
Water Research, Vol 15, No 1, p 17-24, January, 1981. 7 Fig, 7 Tab, 19 Ref.

Descriptors: *Genetics, *Effluents, *Toxicity, *Pulp wastes, *Analytical techniques, Industrial wastes, Water pollution sources, Water analysis, Assay, *Pollutant identification, Evaluation, Mass spectrometry, Gas chromatography.

Sediments from three coastal sites were assayed for mutagenic substances in an attempt to determine effects of nearby pulp and paper mill effluents. Among 28 compounds identified and tested, fluoranthene, pyrene, 2,6-di-tert-butyl-4-methylphenol, dihydroactinidiolide and juvabione were newly identified compounds of the sediments from the paper mill. Extracts were fractionated by the application of high-speed liquid chromatography and subjected to rec and reversion assay with B. subtilis and S. typhimurium and applied to gas chromatography - mass spectrometry analysis. (Titus-FRC)
W81-01846

TOTAL MERCURY AND METHYL MERCURY LEVELS IN BRITISH ESTUARINE SEDIMENTS - II,
Cape Town Univ. (South Africa).
P. D. Bartlett, and P. J. Craig.
Water Research, Vol 15, No 1, p 37-47, January, 1981. 14 Fig, 4 Tab, 22 Ref.

Descriptors: *Mercury, *Estuaries, Statistical methods, Sediments, Sampling, Organic compounds, Chemical analysis, Bacteria, Correlation analysis, *Pollutant identification, Path of pollutants, United Kingdom.

Results of various studies of total mercury and methylmercury levels in British estuarine sediments are discussed. Methylmercury formed an average of 0.46% of the total mercury present. Both mercury and methylmercury are associated with the silt fraction and organic rich sediments. Redox potential was found to influence the ambient level of methyl mercury. Data suggest that high sulfide levels enhance dimethyl mercury production in an aerobic environment. Additional research is needed on the relationship of methylmercury levels in sediments to microbiological activity. (Titus-FRC)
W81-01856

EVALUATION OF THE FALSE-POSITIVE ENTEROVIRAL PLAQUE PHENOMENON OCCURRING IN SEWAGE SAMPLES,
Hadassah Medical School, Jerusalem (Israel).
S. Kedmi, and B. Fattal.
Water Research, Vol 15, No 1, p 73-74, January, 1981. 1 Tab, 10 Ref.

Descriptors: *Viruses, *Epidemiology, *Laboratory tests, Water pollution, *Pollutant identification, Microorganisms, Toxicity, Waste water treatment, Sewage, Bacteria, Methodology, Sampling, Groundwater.

Laboratory procedures for limiting false-positive evaluation of viral plaques are discussed. Three samples of sewage, sewage effluent and polluted groundwater were analyzed using the plaque method. Plaques were randomly chosen and further investigated for enteroviruses using a tissue culture system. A large dose of antibiotics was always added to the sewage concentrate before inoculation into the BGM cell cultures. Plaques which appeared irregular were examined under a microscope. Areas in the tissue culture being evaluated as possible viral plaques in whose vicinity an unidentified particle was seen microscopically were not included in the results. Questionable plaques which could be non-viral were also excluded. It was found that prevention of contamination, stringent examination of plaques, and the short evaluation time used decreased the incidence of false positive results. However, this method may cause underestimation of the true viral concentration. (Titus-FRC)
W81-01857

THE EFFECT OF SURFACTANTS ON THE MIXED CHELATE EXTRACTION-ATOMIC ABSORPTION SPECTROPHOTOMETRIC DETERMINATION OF COPPER, NICKEL, IRON, COBALT, CADMIUM, ZINC AND LEAD,
Australian Atomic Energy Commission Research Establishment, Lucas Heights.
P. Pakalns.
Water Research, Vol 15, No 1, p 7-11, January, 1981. 3 Tab, 2 Ref.

Descriptors: *Surfactants, *Metals, *Spectrophotometry, Analytical techniques, Chelation, Detergents, Mass spectrometry, Chemical analysis, Separation techniques, *Trace elements, Ions.

The possible interference of various surfactants with detection of trace metals in natural waters was investigated. Standard volumes of trace metals were added to surfactant solutions and analyzed by atomic absorption spectrophotometry. It was found that cationic detergent interfered badly with the determination of cobalt and to some extent with cadmium, but for the remainder of the metals investigated, cationic detergent at 10 milligrams per liter gave recoveries between 95 and 103%. Non-ionic detergent also interfered badly with the determination of cobalt. Sodium pyrophosphate and sodium tripolyphosphate interfered significantly with iron and cadmium determination. NTA gave low recoveries for nickel and lead. In polluted natural waters a mixed-chelate method of extraction produced 100% recoveries for all seven metals extracted, and the ammonium pyrolidinedithiocarbamate, or APDC method of extraction required additions of aluminum to release nickel, iron and cobalt from complexiang agents. (Titus-FRC)
W81-01859

EFFECTIVENESS OF THE ORGANIC FLOCCULATION METHOD IN CONCENTRATING ECHOVIRUS 7 AND COXSACKIEVIRUS A9 FROM WATER,
Hadassah Medical School, Jerusalem (Israel).
S. Kedmi, and B. Fattal.
Water Research, Vol 15, No 1, p 13-15, January, 1981. 3 Tab, 7 Ref.

Descriptors: *Public health, *Potable water, *Viruses, *Laboratory tests, *Pollutant identification, Epidemiology, Aquatic microbiology, Microorganisms, Water pollution sources, Water analysis, Testing, Sewage.

A method of detecting low levels of water-borne viruses in drinking water is proposed. It involves two steps, adsorption-beef extract elution and organic flocculation. Studies conducted with echovirus and coxsackievirus produced mean recovery efficiencies of 75%. Results suggest that the method has potential application to commonly found enteroviruses other than polioviruses. (Titus-FRC)
W81-01860

5B. Sources Of Pollution

TRIHALOMETHANES: IMPACT OF BROMIDE ION CONCENTRATION ON YIELD, SPECIES DISTRIBUTION, RATE OF FORMATION AND INFLUENCE OF OTHER VARIABLES,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
R. A. Minear, and J. C. Bird.
In: Water Chlorination, Environmental Impact and Health Effects, Vol 3, p 151-160, 1980. 6 Fig, 2 Tab, 10 Ref. Ann Arbor Science, Ann Arbor, Michigan. OWRT-A-051-TENN(2), 14-34-0001-0145.

Descriptors: *Trihalomethanes, *Water treatment, *Bromides, Carcinogen, *Potable water, *Tennessee, Chloroform, Sampling, Water analysis, Raw water, Treated water, Water pollution, Seasonal.

The objective of this study was to examine the effect of bromide concentration on trihalomethane formation under a variety of conditions that would simulate the drinking water treatment process, by means of lab-scale experiments. Results indicate that bromide concentration directly affects the rate of formation of trihalomethanes, the ultimate concentration after reaction, and the product distribution among the four expected trihalomethanes. Additionally, it was found that the bromide concentration influences the effects of both temperature and chlorine dose on trihalomethane formation. Conclusions indicate the significance of bromide levels in water supplies that are chlorinated.
W81-01656

WATER-QUALITY ASSESSMENT OF THE CYPRESS CREEK WATERSHED, WARRICK COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
L. L. Bobo, and C. A. Peters.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-221989, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-35, May 1980. 67 p, 17 Fig, 12 Tab, 34 Ref.

Descriptors: *Water quality, *Assessments, *Watersheds(Basins), *Mine drainage, *Indiana, Surface waters, Measurement, Watershed management, Flood control, Erosion control, Sediment control, Coal mine wastes, Path of pollutants, Water pollution sources, Chemical analysis, Bacteria, Pesticides, Water analysis, Warrick County(IN), Cypress Creek(IN).

The U.S. Soil Conservation Service needs chemical, biological, microbiological, and hydrological data to prepare an environmental evaluation of the water quality in the Cypress Creek watershed, Warrick County, Ind., before plans can be devised to (1) improve water quality, (2) minimize flood-

ing, (3) reduce sedimentation, and (4) provide adequate outlets for drainage in the watershed. The U.S. Geological Survey obtained these data for the Soil Conservation Service in a water-quality survey of the watershed from March to August 1979. Past and present surface coal mining is the factor having the greatest impact on water quality in the watershed. The upper reaches of Cypress Creek receive acid-mine drainage from a coal-mine waste slurry during periods of intense rainfall. All the remaining tributaries, except Summer Pecka ditch, drain mined or reclaimed lands. The general water type of Cypress Creek and most of its tributaries is calcium and magnesium sulfate. In contrast, the water type at background site 21 on Summer Pecka ditch is calcium sulfate. Specific conductance ranged from 470 to 4,730 micromhos per centimeter at 25 degrees Celsius, and pH ranged from 1.2 to 8.8. Specific conductance, hardness, and concentrations of major ions and dissolved solids were highest in tributaries affected by mining. The pH was lowest in the same tributaries. Concentrations of iron, manganese, and sulfate in water samples and chlordane, DDT, and PCB's in streambed samples exceeded water-quality limits set by the U.S. Environmental Protection Agency. (USGS)
W81-01664

INVESTIGATION OF ACIDITY AND OTHER WATER-QUALITY CHARACTERISTICS OF UPPER OYSTER CREEK, OCEAN COUNTY, NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
T. V. Fusillo, J. C. Schornick, Jr., H. E. Koester, and D. A. Harriman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-103889, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-10, July, 1980. 30 p, 10 Fig, 4 Tab, 21 Ref.

Descriptors: *Water quality, *Acidic water, *Hydrogen ion concentration, *Surface waters, *New Jersey, Groundwater, Swamps, Streamflow, Precipitation(Atmospheric), Chemical analysis, Data collections, Oyster Creek(NJ), Ocean County(NJ).

Water-quality data collected in the upper Oyster Creek drainage basin, Ocean County, N.J., indicate that the stream has excellent water quality except for a persistently low pH. The mean concentrations of the major inorganic ions were all less than 6.0 milligrams per liter. Mean concentrations of total nitrogen and total phosphorus were 0.15 mg/L and 0.01 mg/L, respectively. Dissolved oxygen averaged 8.7 mg/L and 81% saturation. Low pH levels are typical of streams draining cedar swamps. In Oyster Creek, the pH tended to decrease downstream due to chemical and biological processes. The pH levels in swamps were one-half unit or more lower than the pH levels in the adjacent stream. Sharp declines in stream pH were noted during runoff periods as the result of the mixing of poorly-buffered stream water with more highly acidic water from surrounding swamp areas. The quality of ground water within the study area was similar to the quality of streamflow, except for higher iron and ammonia-nitrogen concentrations and a higher pH range of 4.9 to 6.5. Precipitation represented a major source of many chemical constituents in the ground- and surface-waters of the Oyster Creek basin. (USGS)
W81-01665

WATER QUALITY OF THE NEUSE RIVER, NORTH CAROLINA--VARIABILITY, POLLUTION LOADS, AND LONG-TERM TRENDS,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-01668

QUALITY OF WATER AND TIME OF TRAVEL IN YOCKANOOKANY RIVER, CHOCTAW COUNTY, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
G. A. Bednar.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $4.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-770, 1980. 33 p, 5 Fig, 2 Tab, 9 Ref.

Descriptors: *Water quality, *Streamflow, Surface waters, *Mississippi, Hydrologic data, Dye releases, Tracking techniques, Water analysis, Bacteria, *Path of pollutants, Water pollution sources, Time of travel, *Choctaw County(MS), *Yockanookany River(MS).

An intensive water-quality study along a 3.3 mile reach of the Yockanookany River, Choctaw County, Miss., was conducted on August 29-31, 1978. Water-quality data were collected during a period of generally low streamflow and seasonally high air temperatures. The dissolved-solids concentrations were less than 50 milligrams per liter. In the water leaving the study reach, the ammonia nitrogen concentration ranged from 0.10 to 0.40 milligrams per liter and total phosphorus concentrations ranged from 0.14 to 0.43 milligrams per liter. The 5-day biochemical oxygen demand was generally less than 6.0 milligrams per liter and dissolved-oxygen concentrations ranged from 5.5 to 8.1 milligrams per liter. Fecal bacteria densities were high. Fecal streptococcal bacteria in the water leaving the study reach ranged from 460 to 13,000 colonies per 100 milliliters. The rate of solute travel was 0.15 miles per hour through the study reach. (USGS)
W81-01675

SOURCES OF TOXIC COMPOUNDS IN HOUSEHOLD WASTEWATER,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div.
S. W. Hathaway.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-110942, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-128, August, 1980. 90 p, 5 Tab, 15 Ref, 1 Append.

Descriptors: *Domestic wastes, *Pollutants, *Waste water(Pollution), *Water pollution sources, Solvents, Heavy metals, Phenols, Pesticides, Paints, Water pollution, Chemicals, Toxins, Toxic substances, Waste water treatment.

Although it is assumed that the largest contribution of toxic pollutants is from industrial discharges, the identification and concentration of these pollutants from strictly domestic wastewater sources is largely unknown. The occurrence of toxic chemicals in the household wastewater is of great concern not only for municiple wastewater treatment plant discharges but more importantly for small community systems and single dwelling wastewater treatment systems which may have an impact on the ground water quality. This report presents the results of a literature search into the occurrence of the Environmental Protection Agency's selected 129 priority pollutants in household wastewater. Consumer product categories and general types of products containing the toxic compounds used in and around the home are identified. The most frequently used products containing toxic chemicals are household cleaning agents and cosmetics. Solvents and heavy metals are the main ingredients of these products, which are used on a daily basis. Deodorizers and disinfectants containing naphthalene, and phenol and chlorophenols, are also high on the frequency list. Pesticides, laundry products, paint products, polishes, and preservatives are wasted infrequently but are commonly wasted in large volumes. Thus the fate of low level frequent discharges and high level infrequent discharges of toxic chemicals must be addressed in further research work with individual wastewater treatment systems or small community systems. (Moore-SRC)
W81-01683

DISSOLVED OXYGEN MEASUREMENTS IN OHIO STREAMS FOLLOWING URBAN RUNOFF,
Ohio State Univ., Columbus. Water Resources Center.
R. C. Stiefel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-222045, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-092, July, 1980. 84 p, 13 Fig, 1 Tab. R805201-01.

Descriptors: *Urban runoff, *Dissolved oxygen, *Water quality, *Storm runoff, Flow rates, Cities, Ohio, Combined sewers, Water pollution, Streams, Precipitation, Evaluation.

Thirteen towns and cities in Ohio, situated on streams and rivers having different mean daily flow rates, were investigated during the summer and spring of 1977 to determine their suitability as sites for more extensive field studies on the impacts of urban runoff on dissolved oxygen (D. O.) levels in the streams. The towns included Akron, Bucyrus, Delphos, Findlay, Lancaster, Lima, Newark, Norwalk, Tiffin, Upper Sandusky, Wapakoneta, Washington Court House and Wooster. Among factors considered in the selection process were a demonstrable impact of the urban runoff on D. O. levels, accessibility to stream sampling locations, and the availability of stream and precipitation gages. Sites were rejected because (1) poor quality effluents from municipal and industrial treatment plants masked the impacts of combined sewer overflows (CSOs); (2) stream drainage pattern was too complex to monitor; or (3) impacts of the CSOs did not decrease the D. O. to less than 5 mg/l. Only the towns of Lancaster, Newark and Wapakoneta satisfactorily met the criteria established to qualify them as locations for more extensive field studies. (Author's abstract)
W81-01684

MAXIMUM UTILIZATION OF WATER RESOURCES IN A PLANNED COMMUNITY; CONTRIBUTIONS OF REFRACTORY COMPOUNDS BY A DEVELOPING COMMUNITY,
Rice Univ., Houston, TX. Dept. of Biology.
F. M. Fisher.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112880, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-113, August, 1980. 81 p, 7 Fig, 4 Tab, 3 Ref, 2 Append. 802433.

Descriptors: *Chlorinated hydrocarbon pesticides, *Polychlorinated biphenyls, *Community development, *Water pollution, Water resources development, Pesticide residues, Road construction, Land forming, Golf courses, Soil contamination, Artificial lakes, Drainage system, Fish, Storm water, Return flow, Mirex, Chlordane, Water utilization, Environmental effects, Planned community.

This project was undertaken to examine the role of a developing community in contributing refractory organochlorine compounds to the aquatic ecosystem. Water, soil, and biotic components from a natural drainage system in The Woodlands, Texas, were assayed for halogenated compounds. In addition, components from two man-made lakes and the recipient stream were evaluated. Polychlorinated biphenyl (PCB) residues were detected during each year of the three-year study. The levels of PCBs were highest during the first year (about 350 ppb in soil and animal samples) and diminished to 1/10 of those values during the second and third years of study. The highest residue values were coincident with the period of development when cut and fill operations, roadbed construction, and service installation were being effected. Mirex was found in soil, water, and organisms from the drainage area around The Woodlands Golf Course, as were residues of chlordane. The pesticide levels in fish never exceeded 5.6 ppb for mirex and 6.1 ppb for chlordane. Both compounds were apparently transported into the Conference Center Lakes by stormwater or washed in by returning irrigation water from the golf course. Fish from Panther Branch, which receives stormwaters from overlfow of the Conference Center Lakes, contained less than one fourth the amount of mirex and chlordane found in golf course sam-

plings. The data indicated that biotic and abiotic components of the lakes serve as effective sumps for these pesticides. (Moore-SRC)
W81-01686

THE EFFECTS OF LIGHT ON THE DISSIPATION OF CHLORINE IN SEA-WATER,
Old Dominion Univ., Norfolk, VA. Inst. of Oceanography.
G. T. F. Wong.
Water Research, Vol 14, No 9, p 1263-1268, September, 1980. 4 Fig, 1 Tab, 17 Ref.

Descriptors: *Sea water, *Chlorination, Ambient light, Laboratory tests, Light intensity, *Light penetration, *Chlorine, Bromine, *Chemical reactions, Dissipation, Residual chlorine, *Chesapeake Bay.

A laboratory investigation of the effects of light on the dissipation of chlorine in sea water samples collected near the mouth of the Chesapeake Bay is reported. Bromate is one of the products formed when chlorinated sea water is exposed to light; the rate and amount of bromate formation increase with the intensity of the light. The increase of chlorine demand in the presence of light can be accounted for only partially by the formation of bromate. Other, unidentified reactions must also occur. Even in the absence of light some unidentified species are formed. Thus, the effects of light on the rate and mechanism of the dissipation of residual chlorine can be significant even at low light intensities. Future studies should consider the fate of chlorine in the light and in the dark. The many possible products formed during the chlorination of sea water must be determined, and their toxicity assessed. (Small-FRC)
W81-01690

MATHEMATICAL MODEL FOR WATER QUALITY IN STREAMS IMPACTED BY POINT AND NONPOINT SOURCE POLLUTION,
Kentucky Water Resources Research Inst., Lexington.
M. E. Meadows.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170367, Price codes: A04 in paper copy, A01 in microfiche. Research Report No 126, 1981. 60 p, 8 Fig, 3 Tab, 23 Ref. OWRT-A-078-KY(1), 14-34-0001-9019, 14-34-0001-0119.

Descriptors: *Storm runoff, Small watersheds, Storm water, *Water pollution, *Streamflow, *Model studies, Water quality, Streams, Mathematical models, *Path of pollutants, Pollutant transport, Storm water quality, Nonpoint source pollution, Water quality modeling, Unsteady streamflow, Kinematic streamflow.

Modeling the impacts of stormwater runoff on small streams requires that the prediction model has the capability of simulating the behavior of the hydrologic and water quality components of the stream system. Development of such a model involves coupling the equations for pollutant transport during flow with the appropriate flood routing equations. The decision on which equations to choose requires a full understanding of the pollutant transport and hydrograph dispersion processes. This research was undertaken to develop a rigorous theoretical evaluation of the pollutant transport and hydrograph dispersion process during unsteady flow, and to recommend a suitable model for simulating the impact of stormwater on small streams. It was determined that the one dimensional convective - dispersive equation for tracers (pollutants) coupled with a form of the diffusive wave model for unsteady streamflow would provide the basis for a simulation model that is both simple and consistent with the principal transport process. Evaluation of the dynamic terms in the momentum equation yielded general estimators to model parameters and established that the Muskingum routing model is consistent with the modified diffusive wave model developed during this research. The coefficient for hydrograph dispersion was tested on tracer dispersion data and was found to be a reasonable prediction equation for channels with top widths less than 115 feet and bed slopes greater than 1.6 feet per mile. Most small streams satisfy these conditions.
W81-01694

NON-POINT SOURCE POLLUTION IN FOREST STREAMS OF THE WESTERN OLYMPIC MOUNTAINS,
Washington Univ., Seattle. Coll. of Forest Resources.
D. D. Wooldridge, and A. G. Larson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170342, Price codes: A06 in paper copy, A01 in microfiche. Project Completion Report, September 5, 1980. 103 p, 27 Fig, 9 Tab. OWRT-B-076-WASH(1), 14-34-0001-8127.

Descriptors: *Water pollution sources, *Forest watersheds, *Washington, *Non-point pollution, Road construction, Clear-cutting, Overland flow, Streams, Inflow, Dissolved solids, Nutrient cycling, Suspended sediment, Forest ecosystems, Forest management.

Several watershed studies of forest ecosystems have identified inputs of certain elements in precipitation and outputs from the ecosystem in streamflow. Effects of silvicultural activities on the elemental composition, sediment, and temperature of streamflow also have been reported. This study of experimental watersheds in the western Olympics subdivided the forest ecosystem into zones and identified the concentrations and elemental migration of certain elements between zones. Initial study identified processes of the undisturbed forest. Alteration of these processes by road construction and clearcut forest harvest also was studied. The mode of study evaluated the effects of silvicultural activities on non-point sources pollution with use of Best Management Practices for road construction, felling and bucking of timber, and yarding. Concepts and principles of environmental geochemistry were incorporated in the analyses of cause and effect relationships between ecosystem processes, non-point sources of pollution, and water quality. Elemental migration through zones of the ecosystems is related to abundance and characteristics of the element as well as biological processes. Dissolved constituents found in streamflow of the western Olympics have their primary source in geochemical weathering of parent materials and bedrock. HCO sub 3, Ca, SiO sub 2-Si, and Cl were dominant constituents of streamflow (65, 19, 6, 4%, respectively). Based on initial comparisons of dissolved constituents in streams for pre- and postlogging in this study, and results of other studies, it is concluded that the dissolved water quality of streams from managed forest watersheds will exceed both the drinking water quality standards and the median quality currently used by the 100 largest U.S. cities.
W81-01695

SEASONAL VARIATIONS IN TRIHALOMETHANE LEVELS IN AN IOWA RIVER WATER SUPPLY,
Oklahoma State Univ., Stillwater.
J. N. Veenstra, and J. L. Schnoor.
Journal of the American Water Works Association, Vol 72, No 10, p 583-590, October, 1980. 13 Fig, 4 Tab, 23 Ref. OWRT-A-072-IA(1).

Descriptors: *Iowa River, Fluctuations, Water treatment, *Organic compounds, Iowa, Wells, Rivers, Seasonal, Oxidation, Temperature, Hydrogen ion concentration, Physical properties, Chlorination, Gas chromatography, Bromides, Water pollution sources, Solar radiation, *Humic acids, *Fulvic acids, Potable water, *Trihalomethane.

Water samples taken at two sites along the Iowa River, one upstream and one downstream from the Coralville Reservoir were analyzed for seasonal variations in trihalomethane (THM) levels. Total THM (TTHM) levels at the Coralville well and the effects of chlorination and solar radiation upon THM production in Iowa River water were also examined. Results of gas chromatographic studies on water samples indicated that humic and fulvic acids were the predominant peaks showing seasonal variations. TTHM levels varied seasonally from 50 to 335 micrograms/liter in samples concentrated about 1.4 times. Brominated THM levels were highest in late fall and winter coinciding with patterns of bromide ion concentrations. It was concluded that seasonal variations in the nature of the precursors was the main determinant of final TTHM levels in Iowa River water. Temperature and pH had little effect on THM seasonal variations. Water samples from the Coralville well contained haloforms which were composed of about 88% brominated compounds as compared to surface water which was made up of 27% brominated compounds in its haloform composition. When the point of chlorination was moved back in the treatment of the Iowa River water, TTHMs were produced. Solar radiation reduced THM production by reducing chlorine content of the water rather than by reducing the level of THM precursors. (Geiger-FRC)
W81-01709

CAPACITY OF ACTIVATED SLUDGE SOLIDS FOR VIRUS ADSORPTION,
California Univ., Los Angeles. Dept. of Chemical, Nuclear and Thermal Engineering.
For primary bibliographic entry see Field 5D.
W81-01710

ADSORPTION MASS TRANSFER MODEL FOR VIRUS TRANSPORT IN SOILS,
California Univ., Los Angeles. Dept. of Chemical, Nuclear, and Thermal Engineering.
V. L. Vilker, and W. D. Burge.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127210, Price codes: A04 in paper copy, A01 in microfiche. Water Research, Vol 14, No 7, p 783-790, July, 1980. 6 Fig, 3 Tab, 13 Ref. (California Water Resources Center Project UCAl-WRC-W-523). OWRT-B-184-CAl(7).

Descriptors: *Viruses, *Mathematical models, Bacteriophage, Soil testing, Soil properties, Isotherm, Adsorption, Aquatic microbiology, Activated carbon, Columns, Migration, *Path of pollutants, Mass transfer, Soils.

An adsorption mass transfer model was applied to describe virus association with soils and soil components. The analysis indicates that virus adsorption to activated carbon, soils, and soil components is saturation limited. Although the number of adsorption sites, Q, is large, the association of virus particles with them is characterized as weak due to the small value of the isotherm equilibrium parameter K sub L. An adsorption mass transfer model adequately describes the rate of adsorption in batch systems and percolating soil beds. The method was illustrated by calculation of the bacteriophage theta xi-174 profiles in a column of silt loam soil. Animal virus profiles in specific soils can be calculated by the same method when the isotherm parameters K sub L and Q and the mass transfer coefficient K sub f are known. Verification of this model by experimental studies with virus-soil adsorbent systems for which these parameters are known is needed, especially for the animal viruses. Future models will require that the timescale of transport through soil beds of practical depths found in the field incorporate the effect of natural inactivation in order to assess virus breakthrough. (Snyder-California)
W81-01711

A SUBSURFACE WATER QUALITY MODEL FOR WESTERN SURFACE MINE SITES,
North Dakota Water Resources Research Inst., Fargo.
R. D. Koob, D. E. Tallman, G. Groenewald, B. Rehm, and J. Cherry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170557, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, Feb., 1981. 4 p. From Symposium on Surface Mining Hydrology, Univ. of Kentucky, Lexington, Dec 1-5, 1980, p 465-473. OWRT-B-053-NDAK(1), 14-34-0001-9089.

Descriptors: Geochemistry, *Hydrogeology, Surface runoff, *Mining, Industrial wastes, *Subsurface waters, *Water pollution sources, Model studies, Water quality, Soil analysis, Soil chemistry, Clay minerals, Soil chemical properties, Mineralogy, Mining engineering, Strip mines, Water analysis, Groundwater, Analysis, Anions, Cations, Ions, Planning, Forecasting, Projections, Estimating, North Dakota, Wyoming, Montana, Canada, *Baseline studies, Strip mines.

Regional similarities in chemical characteristics of shallow groundwater were indicated from hydrochemical data from proposed surface mining sites in North Dakota, Montana, Wyoming, and Alberta. Groundwater similarity characteristics were noted for dominant anions (sulfate and bicarbonate) and cations (sodium and calcium), pH (7-9), and electrical conductance of shallow groundwater (500-4500). A hydrogeochemical model was developed for this region, based on mineralogical data and unsaturated/saturated zone hydrochemical characteristics. Critical hydrogeochemical processes were considered. Mineralogical variability results in significant groundwater quality differences within/between proposed mining sites. The model suggests a severe potential for groundwater degradation in certain Northern Great Plains (NGP) mine settings, especially where unoxidized pyritic and sodium montmorillonitric overburden exist in the near-surface weathering zone (sulfate and sodium in NGP spoils range up to 10 grams/liter and 3.5 grams/liter, respectively, in sodic-pyritic overburden areas). Groundwater degradation can be minimized if key mineralogical variables (as a function of the original sediment depositional settings) are understood and integrated within the mine design framework. (Zielinski-IPA)
W81-01751

WASTE WATER SPRAY TRANSPORT IN LAND APPLICATION,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5A.
W81-01761

EVALUATION OF MANGEMENT PRACTICES ON THE BIOLOGICAL AND CHEMICAL CHARACTERISTICS OF STREAMFLOW FROM FORESTED WATERSHEDS,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 4C.
W81-01763

BACTERIAL AEROSOLS PRODUCED FROM A COOLING TOWER USING WASTE WATER EFFLUENT AS MAKEUP WATER,
Army Proving Ground, Dugway, UT.
A. P. Adams, M. Garbett, H. B. Rees, and B. G. Lewis.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 498-501, March, 1980. 3 Tab, 6 Ref.

Descriptors: *Cooling water, *Bacteria, *Reclaimed water, Effluents, Chlorine, Cooling towers, Coagulation, Aerosols, Air pollution, Nutrients.

The potential aerosol hazard produced by the use of waste water effluent as make-up water for cooling towers was investigated, and methods for controlling the bacteria were studied. Bacteria found in the cooling water basin at an 85 MW plant in the southwestern US were determined, and bacteria bearing particles exiting the cooling towers were measured. Chlorine was effective in reducing the number of bacteria, while coagulation was even more effective. However, after all treatments, the total number of bacteria in the tower, except for enteric bacteria, increased rapidly. While coagulation treatment reduced the amount of phosphate and bacteria in the effluent of the plant, it had little effect on removing dissolved nutrients, as was demonstrated by the regrowth of Pseudomonas. An electric utility using chlorine dioxide as a tower disinfectant emitted fewer bacteria-bearing particles. However, an electric utility using polluted river water as cooling water emitted the most bacteria. (Small-FRC)
W81-01764

POLIOVIRUS RETENTION IN 75-CM SOIL CORES AFTER SEWAGE AND RAINWATER APPLICATION,
Brookhaven National Lab. Upton, NY. Dept. of Energy and Environment.
E. F. Landry, J. M. Vaughn, and W. F. Penello.
Applied and Environmental Microbiology, Vol 40, No 6, p 1032-1038, December, 1980. 2 Fig, 3 Tab, 20 Ref.

Descriptors: *Viruses, *Water pollution sources, *Polio viruses, *Soil contamination, Public health, Path of pollutants, Cores, Sewage effluent, Rain water, Recharge, Groundwater recharge, Infiltration rates, Soil water movement, Long Island, Adsorption, Microorganisms.

Guanidine-resistant poliovirus LSc was chosen as a test strain to measure adsorption by Long Island soils in an experimental recharge basin. Polyvinyl chloride pipes were driven into the basin surface. The soil within the pipes was infiltrated at the rate of 1 cm per hour with seeded sewage effluent and allowed to drain. Analysis of the viruses in the 75 cm soil core showed that 77% of the viruses were adsorbed in the first 5 cm, 11% in the second 5 cm segment, 8% in the 10 to 30 cm section, and 4% uniformly distributed throughout the remainder of the 75 cm length. Less than 0.22% was detected in the core filtrates. Rinsing with either sewage effluent or rain water eluted only an additional 0.16%, showing that there was little virus movement from the core. Migration within the core was studied by rinsing virus-treated soil with rainwater and sewage effluent. In the top 5 cm segment, these did not differ from the control. In the 5 to 10 cm section, the control contained 9.29% of the viruses; rain water-rinsed, 18.25%; and sewage-rinsed, 4.36%. No significant differences were seen in the 10 to 15 cm section. In the rain water core, viruses apparently migrated from the middle section into the deeper part. Sewage-rinsed soil contained more viruses at the 25 to 50 cm depth than the control, but less than rain water. Although this data is typical for a number of enterovirus types, it may not apply to other soils, higher infiltration rates, and viruses which adsorb poorly in soils. (Cassar-FRC)
W81-01770

EFFECTS OF ENVIRONMENTAL VARIABLES AND SOIL CHARACTERISTICS ON VIRUS SURVIVAL IN SOIL,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
C. J. Hurst, C. P. Gerba, and I. Cech.
Applied and Environmental Microbiology, Vol 40, No 6, p 1067-1079, December, 1980. 10 Fig, 2 Tab, 18 Ref.

Descriptors: *Soil properties, *Viruses, *Waste water disposal, *Regression analysis, *Water pollution sources, Variability, Microorganisms, Soil moisture, Hydrogen ion concentration, Adsorption, Phosphorus compounds, Aluminum, Organic matter, Temperature, Disposal, Conductivity, Cation exchange, Ultimate disposal, Sewage effluent.

The effects of soil and environmental variables on the persistence of waste water viruses in soil were studied using test samples of soil wetted with suspensions of virus in distilled water, secondary sewage effluent, or mixtures of effluent and water. Virus strains used were coxsackieviruses A9 and B3, echovirus 1, poliovirus 1, rotavirus SA11, and bacteriophages T2 and MS2. Temperature had a large effect on survival of the viruses, inactivation rates increasing with temperature. Virus survival under aerobic nonsterile conditions was less than that occurring in other conditions tested--aerobic sterile, anaerobic sterile, and anaerobic nonsterile. As soil moisture increased, virus survival decreased to a minimum at 15%, then increased with added soil liquid. Considering 10 soil characteristics, the most influential (virus adsorption to soil, extractable phosphorus, exchangeable aluminum, and pH) accounted for 51% of all the variance in the experiment. Statistically insignificant factors were % silt, % organic matter, conductivity, surface area, exchangeable calcium, and total cation exchange capacity. (Cassar-FRC)
W81-01771

EFFECTS OF ADAPTATION ON BIODEGRADATION RATES IN SEDIMENT/WATER CORES FROM ESTUARINE AND FRESHWATER ENVIRONMENTS,
Environmental Research Lab., Gulf Breeze, FL.
J. C. Spain, P. H. Pritchard, and A. W. Bourquin.
Applied and Environmental Microbiology, Vol 40, No 4, p 726-734, October, 1980. 8 Fig, 2 Tab, 12 Ref.

Descriptors: *Microorganisms, *Biodegradation, Methyl parathion, p-Nitrophenol, Aquatic bacteria, Bacteria, *Sediments, Cores, Estuaries, Pesticides, Adaptation, Freshwater.

Adaptation among natural microbial populations exposed to methyl parathion (MP) and p-nitrophenol (PNP) was investigated. Specific attention was directed to the issue of whether adaptation could affect predictions of biodegradation rates for xenobiotics at low concentrations in the environment. A preliminary experiment was conducted to determine whether adaptation could be detected in mixed cultures by following mineralization. For this study, a number of ecocores were taken from the Escambia River sampling site, spiked with MP or PNP and analyzed. Both MP and PNP were mineralized much more rapidly in cores preexposed to the compounds at a concentration of 180 micromolar PNP. Cores that received lower concentrations of the parent compounds, 0.45 micromolar released carbon dioxide at a much lower overall rate. Differences in initial biomass concentrations at the sample sites did not account for differences in adaptation patterns. The addition of yeast extract to flasks containing samples from a specific site did not facilitate adaptation, indicating that nutrient limitations was not the deciding factor. Organisms able to degrade MP in pure culture were not isolated from either sampling site. The fact that preexposure to PNP increases the fraction of the population able to degrade PNP supports the idea that a particular segment of the population is selected by exposure to the nitrophenol. The ability of the microbial population to adapt and rapidly degrade a compound may be an additional rate-determining factor. (Baker-FRC)
W81-01772

CHEMICAL COMPOSITION OF RECENT BOTTOM SEDIMENTS OF THE LAKE ZAGNANIE,
Akademia Rolniczo-Techniczna, Olsztyn-Kortowo (Poland). Inst. of Hydrobiology and Water Conservation.
T. Januszkiewicz, and K. R. Januszkiewicz.
Acta Hydrobiologica, Vol 22, No 2, p 157-178, 1980. 6 Fig, 2 Tab, 34 Ref.

Descriptors: *Lake sediments, *Bottom sediments, *Lake Zagnanie(Poland), *Chemical analysis, Water pollution sources, Limnology, Eutrophication, Poland, Water pollution effects, Sewage, Organic matter, Calcium carbonate, Metals, Phosphates, Phosphorus compounds, Nitrogen compounds, Manganese, Farm wastes.

The upper layer (15 to 20 cm thick) of sediments at the bottom of Lake Zagnanie, Poland, was analyzed chemically as part of a study to determine whether pollutants from farms and sewage disposal were responsible for recent decreases in fish harvests. Among the many analyses performed were pH, water content, organic matter content, insolubles, ammonia nitrogen, total nitrogen, phosphates, total phosphorus, sulfates, total sulfur, silica, and several metal oxides. The major sediment components were calcium carbonate, silica, and organic matter. Anthropogenic sources were believed responsible for the higher levels of organic matter, sulfides, iron and manganese found near the mouth of an inlet river. Iron and aluminum act as floccu-

lants for Mn-phosphorus complexes that were found. (Cassar-FRC)
W81-01791

RURAL NONPOINT SOURCE WATER QUALITY IN A SOUTHEASTERN WATERSHED,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
F. J. Humenik, L. F. Bliven, M. R. Overcash, and F. Koehler.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 29-43, January, 1980. 6 Fig, 8 Tab, 13 Ref.

Descriptors: Streams, Watersheds(Basins), *Land use, *Water quality, *Rural areas, *Runoff, Nutrients, Soil chemistry, Seasonal, Channeling, *North Carolina.

An interpretation of rural stream water quality in the Chowan River basin is presented which is based on a two-year grab sampling program. Data analyses are summarized by sections which present overall basin data, comparisons between physiographic areas, relationships between water quality and land use, comparisons of channelized and nonchannelized stream water quality, analyses of seasonal fluctuations, and concentration versus water yield analysis. The four areas of the basin sampled had relatively constant mean nutrient concentrations. The greatest variation was seen between the piedmont and the coastal plain areas. This was thought to be due to natural variations in soil type, etc. There was no clear relationship between water quality and land use, but these results may be due to the limited number of sampling sites. Seasonal trend analysis indicated that nutrient loads were greater during the winter and spring, reflecting rainfall cycles. The effect of channelizing was pronounced with respect to the high NO3-N concentrations found in channelized streams. Nutrient concentrations showed no consistent relationship with flow. (Small-FRC)
W81-01804

CYANIDE PROBLEMS IN MUNICIPAL WASTE WATER TREATMENT PLANTS,
Metropolitan Sanitary District of Greater Chicago, IL. Development Div.
D. T. Lordi, C. Lue-Hing, S. W. Whitebloom, N. Kelada, and S. Dennison.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 597-609, March, 1980. 6 Fig, 8 Tab, 14 Ref.

Descriptors: *Toxins, *Municipal wastes, *Water quality standards, Illinois, Industrial wastes, Treatment facilities, Performance, Effluents, Toxicity, Minnows, *Cyanide.

The occurrence of cyanide, the distribution of cyanide species in waste water, and the control of cyanide are discussed. Cyanide levels in the Metropolitan Sanitary District of Greater Chicago (MSDGC) treatment plant effluents have been monitored daily since 1972. All of the plants had daily cyanide concentrations that at times exceeded 0.025 mg/liter, the Illinois Pollution Control Board's original effluent limit. The Calumet plant, which receives water from a highly industrialized area including five steel plants, had the highest cyanide levels, with an annual average of 0.095 mg/liter. The major portion of the cyanide was found to be in complex form (iron or cobalt cyanide complexes). The average cyanide removal rates by the industrialized plants were 0-91%. A series of 96-hour acute toxicity tests was performed using unchlorinated, nitrified and non-nitrified effluent from the plants on fatheaded minnows. There was no evidence of toxicity, probably because cyanide occurred in complexes of reduced toxicity. The new Illinois cyanide standard is 0.10 mg/liter of total cyanide as a monthly average and 0.20 mg/liter for any 24-hour period. (Small-FRC)
W81-01819

LONG-TERM EFFECTS OF IRRIGATION WITH WASTE WATER,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 3C.
W81-01823

IMPACT OF SEDIMENTS ON DISSOLVED OXYGEN CONCENTRATIONS FOLLOWING COMBINED SEWER OVERFLOWS,
Rexnord Inc., Milwaukee, WI. Environmental Research Center.
W. A. Kreutzberger, R. A. Race, T. L. Meinholz, M. Harper, and J. Ibach.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 192-201, January, 1980. 8 Fig, 4 Tab, 8 Ref.

Descriptors: *Dissolved oxygen, *Sediments, *Overflow, *Combined sewer overflows, Rivers, Water pollution sources, Scour, Temperature, Velocity, Wisconsin, *Milwaukee(WI), Milwaukee River.

The effect of combined sewer overflow on the Milwaukee river was investigated for the following three purposes; to demonstrate that sediments are the source of the large wet weather oxygen demand, to show that scouring by submerged combined sewer overflow outfalls is the mechanism by which this demand is exerted, and to develop a method of predicting the impact of sediment scouring on dissolved oxygen levels. This information can help in the development of realistic receiving water models. Field investigations monitored dissolved oxygen, temperature, disturbed and undisturbed sediments, and water velocity. Data were analyzed using multiple linear regression. Sediment oxygen demand rates indicated that the river is a significant sink for dissolved oxygen even in dry weather. Velocity measurements in the vicinity of combined sewer outfalls indicated that the scouring of sediments by discharges is the probable mechanism by which the sediments cause rapid drops in dissolved oxygen levels. Combined sewer overflow abatement is recommended. (Small-FRC)
W81-01843

RETENTION OF RADIONUCLIDES BY MOBILE HUMIC COMPOUNDS AND SOIL PARTICLES,
Washington State Univ., Pullman. Dept. of Chemical Engineering.
J. C. Sheppard, M. J. Campbell, T. Cheng, and J. A. Kittrick.
Environmental Science & Technology, Vol 14, No 11, p 1349-1353, November, 1980. 3 Fig, 3 Tab, 12 Ref.

Descriptors: *Adsorption, *Radioactive wastes, *Colloids, Humic acid, Fulvic acid, Nuclear wastes, *Path of pollutants, Soil types, Model studies, Soil water, Percolation, Particle size, Clays, Kaolinite, Cations, Separation techniques, Mathematical studies.

The transport of radionuclides in soils and groundwater may be facilitated by particles of colloidal dimensions. Five US soils (two silt loams, one sand, one loamy sand and a sandy clay loam) were analyzed for particulate and ionic distribution ratios in relation to the effects of the ionic species, humic and fulvic acid complexes of radionuclides and radionuclide-bearing soil colloids (clays). The distributions of radionuclides between the soil and aqueous phases were determined by characteristic spectra of radionuclide-bearing particles. Three broad classes of particles determined the distribution ratios of the soils studied: ionic (particles with radionuclides having radii less than 1 mm); complexes of humic matter, possibly humic acid polymers (2-3 mm radii); and larger soil particles bearing radionuclides with radii of 10-60 mm. Gel filtration studies revealed that humate complexes dominated the distribution ratios for the soil systems tested. Evidence is presented to show that much of the mobility of radionuclides in the soil-aquatic environment is due to soil particles in the 2-3 mm range. Sorption sites for radionuclides appear to be on the surface of the soil particles, with adsorption tendencies of the U, Cs, Sr, and Am cations varying with the charge density of the hydrated ions. Humic complexing of radionuclides tends to alter the migration equation commonly used for soil-aquatic systems and greatly complicates the modeling of radionuclide transport. (Geiger-FRC)
W81-01865

PRODUCTION OF UREA BY BACTERIAL DECOMPOSITION OF ORGANIC MATTER INCLUDING PHYTOPLANKTON,
Yamagata Univ. (Japan). Dept. of Chemistry.
Y. Satoh.
Internationale Revue Der Gesamten Hydrobiologie, Vol 65, No 2, p 295-301, 1980. 2 Fig, 2 Tab, 13 Ref.

Descriptors: *Urea, *Decomposing organic matter, *Bacteria, Water pollution sources, Eutrophication, Organic matter, Lakes, Nitrogen compounds, *Phytoplankton, Fragilaria crotonensis, Aquatic microorganisms, Japan, *Lake Suwa(Japan).

Urea was produced by aerobic bacterial decomposition of Fragilaria crotonensis, a dominant member of the phytoplankton community in water of Lake Suwa, Japan, and by decomposition of surface water organic matter from the same lake. Rate constants of urea production were 0.083 per day for F. crotonensis and 0.051 per day for the organic matter. Urea production reached a peak in the Fragilaria experiment at 5 weeks and then declined toward the eighth week, a possible result of urease activity. Urea levels in the surface organic matter experiment reached a peak at 4 weeks and did not drop. This study shows that urea may be produced in natural waters by decomposition of organic matter as well as by the well-known processes of excretion by aquatic animals and human pollution. (Cassar-FRC)
W81-01866

DIFFERENCE IN THE COMPOSITION OF LINEAR ALKYLBENZENE SULFONATE HOMOLOGUES IN RIVER SEDIMENT AND RIVER WATER,
Tokyo Metropolitan Univ. (Japan).
H. Hon-nami, and T. Hanya.
Japanese Journal of Limnology, Vol 41, No 1, p 1-4, January, 1980. 3 Fig, 2 Tab, 6 Ref.

Descriptors: *Rivers, *Alkylbenzene sulfonates, *Sediments, *Water pollution sources, Detergents, Japan, *Tama River(Japan), Organic compounds.

The composition of linear alkylbenzene sulfonate homologues in surface sediment and water of the Tama River showed unusual differences. In sediment the proportions of C12 and C13 were higher, and the C10 and C11 lower than those in the water. In fact, very little C10 appeared in the sediment. C14 was detected at 1.7% in only one sediment sample, none in water. Total alkylbenzene sulfonate concentrations in sediment were 50 to 500 times as high as in water. As the carbon number of the alkyl groups increased, the ratio of concentration of alkybenzene sulfonates in sediment to that in water increased exponentially. The authors explain this distribution of alkyl groups by stating that the longer the alkyl chain length, the more alkylbenzene sulfonates were adsorbed in the sediment. (Cassar-FRC)
W81-01875

TOXICITIES OF MICROCYSTIS AERUGINOSA COLLECTED FROM SOME LAKES, RESERVOIRS, PONDS AND MOAT IN TOKYO AND ADJACENT REGIONS,
Tokyo Metropolitan Research Lab. of Public Health (Japan).
For primary bibliographic entry see Field 5C.
W81-01876

CITY EXAMINES EFFECTS OF ROAD SALTING ON ITS WATER SUPPLY,
Massachusetts Dept. of Public Works, Worcester.
R. L. Moyland, Jr.
Public Works, Vol 111, No 8, p 59-60, August, 1980.

Descriptors: *Urban runoff, *Salt, *Reservoirs, Urban areas, Water quality, Deicers, Potable water, Sodium compounds, Winter, Highways, *Highway icing, Massachusetts.

The effect of winter salting on the water quality of Worcester, Massachusetts, and the locations where salt could be entering the water supply were investigated. Worcester's water supply is made up of ten surface reservoirs and two gravel packed wells located outside of or on the edge of the city. No runoff from within the city runs into the surface water supply. Roads near the reservoirs are salted and sanded, but sodium readings on the reservoirs indicate no salt contamination. Urban runoff does flow into the Lake Quinsigamond basin, where the one well in use is located. Sodium levels in the well are 26 mg/liter, a moderate level for groundwater. Runoff which flows into the Blackstone River does not enter Worcester's or any other city's drinking supply. The Worcester Department of Public Works has limited the use of salt to streets which are critical to moving traffic through the city. Residential streets are excluded. Uniform application is achieved through the use of automatic spreaders, and salt supplies are kept covered and secured. The department recommends the continued use of road salt. (Small-FRC)
W81-01878

PREDICTION OF THE VOLATILIZATION RATES OF HIGH-VOLATILITY CHEMICALS FROM NATURAL WATER BODIES,
SRI International, Menlo Park, CA.
J. H. Smith, D. C. Bomberger, Jr., and D. L. Haynes.
Environmental Science & Technology, Vol 14, No 11, p 1332-1337, November, 1980. 4 Fig, 4 Tab, 31 Ref.

Descriptors: *Path of pollutants, *Volatilization, *Evaporation, *Atmospheric water, Organic compounds, Water pollution, Water pollution sources, Equations, Mathematical studies, Waste water treatment, Natural streams, Surfactants, Diffusion.

The transport of pollutants from water bodies to the atmosphere by volatilization or evaporation may be an important environmental fate pathway for many chemicals. A simple laboratory procedure which has been used to obtain volatilization rate data for benzene and several chlorinated hydrocarbons is described. The method measures the ratio of the evaporation rate constant of the pollutant to the oxygen reaeration rate constant. This ratio has been shown to be constant for volatile compounds subjected to a wide range of conditions. If the oxygen reaeration rate constant can be estimated or measured in a waste water treatment system or in a natural water body, then the volatilization rate constant of the compound under those same conditions may be calculated by multiplying the value of the ratio by the environmental value of the oxygen reaeration rate constant. The effects of diffusion surfaces and surfactants are also considered. Results indicated that many low-molecular-weight, nonpolar compounds will undergo volatilization as their major environmental fate pathway. (Geiger-FRC)
W81-01899

5C. Effects Of Pollution

AN EVALUATION OF LIME TREATMENT AND SAND DRYING BEDS FOR UPGRADING STABILIZATION POND EFFLUENT,
Dept. of Civil Engineering. Mississippi State Univ., Mississippi State.
J. R. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-167223, Price codes: A11 in paper copy, A01 in microfiche. MS Thesis, August 1980. 229 p, 46 Fig, 26 Tab, 44 Ref, 8 Append. OWRT-A-110-MISS(2), 14-34-0001-8026.

Descriptors: *Cyanophyta, *Salt marshes, Biological communities, Ecological distribution, Light intensity, Bulrush, Mississippi, Biogeography, *Algal control, Sludge treatment, *Lime treatment, Ponds, Effluents, Dewatering, Drying, Sand drying beds, *Edaphic algae, *Graveline Bay Marsh(MS), Schizothrix, Spartina, Juncus, Distichlis.

Removal of algae from stabilization pond effluents is required for the effluent to meet current federal discharge standards. Application of a thickened lime-algae sludge to sand drying beds was investigated as a treatment method. The sludge was loaded at rates of 4.0 to 16.1 gal/sq ft to sand bed columns with media depths of 6 to 12 inches. A sludge cake with an average 25% solids content was obtained within ten hours at bed depths of 6 to 10 inches over the loadings applied, while 65 hours were required for a bed depth of 12 inches at loadings above 12 gal/sq ft. Investigations indicated that dewatering rate and effluent quality were not related to media size from 0.3 to 1.5 mm. Dewatering rates decreased with increasing solids loading from about 1 to 6 lbs/sq ft; however, effluent quality and sludge cake solids depended more on sludge mat formation than on loading. Dewatering rates above 1 gal/sq ft per hr were noted at a bed depth of 10 inches. Effluent suspended solids from the drying beds averaged about 80 mg/l. Supernate withdrawal was effective only when high sludge loadings and/or deep bed depths caused filter binding. In addition, the supernate averaged 175 mg/l of total suspended solids, which would require recirculation to the lagoon.
W81-01653

CADMIUM IN FOREST ECOSYSTEMS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
W. E. Sopper, and S. N. Kerr.
In: Cadmium in the Environment, Pt I, J. O. Nriagu (Ed), John Wiley & Sons, Inc., 1980, Ch 17, p 655-667, 7 Tab, 18 Ref. OWRT-B-083-PA(3), 14-34-0001-5109.

Descriptors: *Cadmium, *Ecosystems, *Vegetation, Metals, Public health, Toxicity, Trees, Irrigation, Soils, Effluents, Cation exchange, Waste water disposal, Irrigation, Water pollution effects, *Forests, *Wastewater quality, Gamelands, Metal concentrations.

Data have been presented showing levels of cadmium in forest vegetation and soils subjected to wastewater irrigation for 16 years. In the old field areas white spruce, goldenrod, and wild strawberry showed no increase in cadmium levels due to wastewater irrigation. Cadmium concentrations in all species were lower in the wastewater-irrigated area than in the control area because of the greater biomass production resulting from the irrigation. This provides evidence that under low cadmium applications in a wastewater disposal system the actual cadmium concentration of some herbaceous vegetation may be decreased. None of the species sampled in the old gamelands area showed a significant increase in cadmium levels as a result of the wastewater irrigation. Soil cadmium status was not significantly affected by wastewater irrigation in either area, except for the increase in cadmium concentration at the 0 to 5 cm depth in the irrigated old gamelands area. Cadmium levels decreased with depth in the soil profile in both treated and control areas. On the basis of information currently available it appears that the introduction of cadmium into forest ecosystems as an indirect result of industrial pollution or through the planned application of municipal wastewater and sludge will have a minimal effect.
W81-01654

MAXIMUM UTILIZATION OF WATER RESOURCES IN A PLANNED COMMUNITY; EUTROPHICATION POTENTIAL OF SURFACE WATERS IN A DEVELOPING WATERSHED,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
C. H. Ward, and J. M. King.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-107138, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-127, August, 1980. 97 p, 29 Fig, 22 Tab, 19 Ref, 1 Append. 802433.

Descriptors: *Eutrophication, *Urbanization, *Algae, *Water pollution, Texas, Water resources development, Stormwater, Low flow, Soil algae, Phosphorus, Nitrogen, Nutrients, Aquatic algae, Community development, Surface drainage, Soil chemistry, Leachate, *Community development, Planned community.

The algal populations in The Woodlands, Texas, were characterized to evaluate the impact of urbanization on the aquatic flora. Several aquatic habitats were sampled on a regular basis to identify factors which influence algal population dynamics. Nutrient limitation studies were conducted to determine which nutrient was most limiting for algal growth during conditions of low flow and stormwater runoff. Water from Hunting Bayou and Westbury Square, developed communities near Houston, Texas, were used in bioassay experiments. The impact of urbanization on edaphic algal populations was also determined. Nutrient limitation studies in Panther Branch and the Conference Center Lakes showed that phosphorus additions to low-flow water increased algal cell yields, while yields in stormwater samples were increased by nitrogen additions. Undisturbed soils had more diverse algal populations, but smaller standing crops, than disturbed soils, even though concentrations of nitrogen and phosphorus were higher than in most disturbed soils. Soil disturbance caused development of a more diverse blue-green algal flora, probably due to accompanying increases in soil pH. Bioassays showed that phosphorus was the nutrient most limiting for algal growth in water leachates of soils. (Moore-SRC)
W81-01685

WATER QUALITY AND BIOLOGICAL EFFECTS OF URBAN RUNOFF ON COYOTE CREEK; PHASE I - PRELIMINARY SURVEY,
Woodward-Clyde Consultants, San Francisco, CA.
R. Pitt, and M. Bozeman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-144487, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-104, August 1980. 81 p, 9 Fig, 35 Tab, 20 Ref, 1 Append. R805418.

Descriptors: *Urban runoff, *Water quality, *Water pollution, *Aquatic life, California, Sediments, Water chemistry, *Environmental effects, Lead, Zinc, Fish, Aquatic algae, Aquatic plants, Invertebrates, Streamflow, Roads, Surface runoff, Nitrites, Ammonia, Sulfates, Silts, San Jose(CA), Coyote Creek(CA).

An evaluation of the receiving water effects of urban runoff is necessary before urban runoff control goals and practices can be established and selected. Coyote Creek, near San Jose, California, receives minimal pollutant discharges, upstream and in the study area, except for urban runoff. The parameters generally analyzed at each sampling station include: fish; benthic organisms; attached algae; rooted aquatic vegetation; sediment size distribution; sediment chemistry; biological tissue analyses for lead and zinc. Receiving water chemistry, runoff water chemistry and yields, and hydrology were also studied for Coyote Creek. Sources of urban runoff pollutants are being investigated and include sampling from source areas such as street surfaces, parking areas, landscaped areas and rooftops. A marked increase in nitrites, ammonia, turbidity, chlorides and specific conductance was found as the creek passed through the urbanized area of the watershed. Sediment samples from urban areas contained higher concentrations of many of the parameters as compared to the non-urban samples. Sulfates, lead, and orthophosphates were notable examples. Much more silt was also found in the urban samples, signifying a greater discharge of finer sediments from the urban area. Lead concentrations in urban samples of algae, crayfish and cattails were 2 to 3 times greater than in non-urban samples, while zinc concentrations were 3 times the non-urban sample concentrations. The non-urbanized section of the creek supports a comparatively diverse assemblage of aquatic organisms including at least 12 species of fish and various benthic macroinvertebrate taxa. The urbanized portion of the stream supports an aquatic community that is generally lacking in diversity

and is dominated by pollution tolerant fish and benthic invertebrates. (Moore-SRC)
W81-01687

HANDLING OF COMBUSTION AND EMISSION-ABATEMENT WASTES FROM COAL-FIRED POWER PLANTS: IMPLICATIONS FOR FISH AND WILDLIFE RESOURCES,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
L. F. Soholt, R. W. Vocke, N. J. Beskid, W. K. Derickson, and M. J. Knight.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-158917, Price codes: A09 in paper copy, A01 in microfiche. Fish and Wildlife Service, Office of Biological Services, National Power Plant Team Report FWS/OBS-80/33, September, 1980. 184 p, 25 Fig, 51 Tab, 333 Ref, 3 Append.

Descriptors: *Wildlife, *Waste disposal, *Powerplants, *Environmental effects, Landfills, Sludge disposal, Revegetation, Water pollution sources, Trace elements, Solid wastes, Fly ash, Toxic substances, Power plant aggregate, Flue gases, Coal, Energy, Effects.

The goals of this report are to: provide a basic introduction to handling of wastes from coal combustion and emission abatement; and present a procedure for evaluating the potential for these wastes to impact fish and wildlife resources. Coal combustion ashes and flue-gas-desulfurization (FGD) sludges, the solid waste products from coal-fired facilities, contain a number of trace elements that can be toxic to biota if they are available in sufficient quantities. Both ashes and FGD sludges are usually deposited in pond or landfill storage areas. Dispersal of constituents from waste-storage sites occurs primarily by runoff, seepage, and wind erosion. Generally, pond storage methods, even when properly managed, have a greater impact upon fish and wildlife resources than do landfill methods. Proper management of storage sites reduces the amount of waste constituents that are dispersed into the environment. The potential for uptake of trace elements to toxic levels is dependent upon a number of factors including: pH of the dispersal and growth media; capacity of the dispersal and growth media to bind elements in a form unavailable for uptake; magnitude of biological concentration of elements in primary producers and succeeding trophic levels; and tolerances of individual species. After the active lifetime of a waste-storage site, revegetation is desirable as a means of controlling erosion and regaining potential fish and wildlife habitat. Four model waste-storage sites are used to illustrate the methods of assessment presented in this report. (Moore-SRC)
W81-01688

TRANSMISSION OF VARIOUS SALMONELLAE AMONG FISH (CRASSIUS AUTATUS) IN THE AQUATIC ENVIRONMENT,
Purdue Univ., Lafayette, IN.
R. L. Lawton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173767, Price codes: A04 in paper copy, A01 in microfiche. Master of Science Thesis, 1979. 56 p, 2 Fig, 10 Tab, 54 Ref. OWRT B-076-IND(9).

Descriptors: *Salmonella, *Aerobic bacteria, *Aquatic environment, *Fish, Water pollution, Eutrophication, Effects, Bottom sediments, *Fish diseases, Infection.

The infection rates of various Salmonella serotypes for goldfish (C. auratus) were evaluated under a number of controlled environmental conditions. Studies were undertaken to determine the number of salmonellae necessary to cause infection, and to elucidate the conditions instrumental to the pathogen's continued persistence in the aquatic environment. All 32 strains (representing 12 serotypes of Salmonella) studied were shown to infect C. auratus. Under appropriate physiological conditions, the fish were infected for a period of two weeks with less than one organism/ml water (based on MPN analysis). Physiological stress to the fish augmented infection rates. Increased eutrophy was correlated with lowered infection rates and decreased survival of the pathogen. The presence of a bottom sediment under these same eutrophic conditions produced infections of six weeks duration. Isolation of salmonellae from the gastrointestinal tracts of the fish suggested that colonization of the fish viscera occurred in these experiments. A cycle of reinfection, i.e. fish to water to fish, could have taken place. The presence of fish constituted an important element for the survival of Salmonella in freshwater.
W81-01692

ENVIRONMENTAL CONTROL OF PITHOPHORA OEDOGONIA (CHLOROPHYCEAE) AKINETE GERMINATION,
Purdue Univ., Lafayette, IN. Dept. of Botany and Plant Pathology.
D. F. Spencer, T. R. Volpp, and C. A. Lembi.
Journal of Phycology, Vol 16, p 424-427, 1980. 3 Fig, 3 Tab, 16 Ref. OWRT B-081-IND(3).

Descriptors: *Algae, *Cladophora, *Germination, *Environmental control, Akinete, Lakes, *Indiana, Cladophorales, Filamentous, Green algae, Life cycles, Pithophora, Spores, Nutrients, Temperature, *Surrey Lake(IN).

Abundance of Pithophora oedogonia akinetes displayed seasonal changes, being greatest in winter and lowest in summer. Akinete abundance showed significant ($P<0.001$) negative correlations with photoperiod ($r = -0.53$) and water temperature ($r = -0.75$) during the period February 1978 through June 1979. Experiments in which akinete germination was studied in response to manipulations of nutrients (NO sub 3 -N and PO sub 4 -P), photoperiod and temperature indicated that temperature was the primary factor regulating the timing of the vernal flush of akinete germination observed in Surrey Lake.
W81-01699

EPIFAUNAL INVERTEBRATES AS MONITORS OF WATER QUALITY IN LAKE PONTCHARTRAIN,
New Orleans Univ., LA. Dept. of Biological Sciences.
M. A. Poirrier.
In: Proceedings, Third Coastal Marsh and Estuary Management Symposium. p 105-111. Louisiana State University Division of Continuing Education, Baton Rouge, LA, 1979. J.W. Day, Jr., D.D. Culley, Jr., R.E. Turner, and A.J. Mumphrey, Jr., eds. OWRT-A-041-LA(2).

Descriptors: *Water pollution effects, *Aquatic life, *Lakes, Louisiana, New Orleans(LA), *Lake Pontchartrain(LA), Physicochemical properties, Chemical analysis, Bioindicators, Invertebrates, Pollutant identification, Water quality, Estuarine environment.

The distribution and abundance of epifaunal invertebrates was investigated as a means of assessing and monitoring the impact of adverse water quality upon aquatic life. Species zonation along pollution and salinity gradients in Lake Pontchartrain was studied. Many species occurred in zones along these gradients, indicating a relationship between water quality and distribution, and hence, potential as indicator species. Computer principal components and discriminant functions analyses were used to establish species groups and to compare the distribution of these groups with water quality paramenters. As in other studies, the number of species decreased along pollution gradients and highly polluted habitats were dominated by tolerant, opportunistic forms. Salinity was found to be the factor most highly correlated with species distribution. Several species appeared to be good salinity indicators because of changes in abundance and morphology along salinity gradients. Taxonomic and life history studies were conducted and numerous new distributional records established. Studies on the impact of the 1973 and 1975 Bonnet Carre Spillway opening were also conducted.
W81-01700

VIEWS OF A PROMINENT CONSERVATIONIST,
Victoria Univ. (British Columbia).
R. Haig-Brown.
In: Pollution and the Fisheries: Proceedings 27th Annual Meeting of the Fisheries Council of Canada, Environmental Protection Service Report No EPS-3-WP-73-4, August, 1973, p 3-12.

Descriptors: *Water pollution effects, Water quality, Oceans, *International waters, *Commerical fishing, *Aquatic life, *Conservation, Effects, Fishkill, Radioactivity effects, Toxicity, Water pollution, Water quality control, International waters, Bodies of water, Estuaries, Lagoons, Marine fisheries, Pesticides drift, Oil spills, Water pollution sources, Wastes, Chemical wastes, Fish toxins, Fish populations.

Water pollution in world-wide terms was discussed, including some assessment of the risks of degrading the oceans themselves. The risk and possibility of degrading the oceans and largely destroying their present potential values is very real without some change in present trends. Broad-scale pollution already exists through fallout of pesticides and nuclear and industrial wastes. To illustrate, Russia has reported significant levels of strontium-90 in pelagic fish eggs in the Black Sea. Long-lived pollutants (pesticides, radioactive substances) can disperse over thousands of miles, and eventually through the entire general system of the ocean. Ocean transportation of oil and deep sea mining represent additional threats. Pollution in rivers, river estuaries, lagoons, saltmarshes, shallow seas, and out over the continental shelf, compound the problems. In a major Canadian estuary (the Fraser), one of the world's greatest salmon producers, daily loadings of 129 million gallons of chlorinated sewage are proposed. Vigilance on the part of coastal States, as well as international guidance and standards are needed. It was concluded that, should pollution continue at its present rate, the best estimate of continuing ocean life is between 50-100 years. (Zielinski-IPA)
W81-01704

GOVERNMENT PHILOSOPHY AND ACTIVITIES,
P. M. Higgins.
In: Pollution and the Fisheries: Proceedings, 27th Annual Meeting of the Fisheries Council of Canada, Environmental Protection Service Report No EPS-3-WP-73-4, August, 1973, p 13-21.

Descriptors: *Water pollution control, *Water law, *Canada, *Fisheries, *Fish toxins, Pollution abatement, Planning, Legal aspects, Administrative decisions, Constitutional law, Legislation, Water policy, Water quality, Water quality control, Water pollution sources, Water pollution, Foreign countries, Geographical regions, Regions, North America, Governments.

The Canadian Federal Fisheries Act, one of the first Acts of Parliament, was recently amended to significantly strengthen pollution control provisions. Section 33, subsection 12, provides that 'the Governor in Council may make regulations prescribing: (1) substances and classes of substances; (2) quantities, or concentrations of substances; (3) treatments, processes and changes of water.' Pollution control program alternatives and development of regulations were discussed. It was concluded that the effluent regulations for fish processing plants being developed under Section 33 of the Fisheries Act will contain a number of important ingredients: (1) maximum requirements for uniform national application that may be superseded by more stringent local requirements where appropriate; (2) incorporation of practical (economic/technologic) recycling/recovery technology expressed in terms of permissible limits of substances (quantity/production units); (3) development by joint Federal/provincial/industry liaison and reviewed individually with Provincial Pollution Control Agencies; (4) initial immediate application to all new installations and by individually-negotiated time schedules for existing facilities; and (5) dynamically reflect the state of pollution control technology through periodic review. (Zielinski-IPA)
W81-01705

EALTH CONSIDERATIONS IN THE PREPA-ATION OF DRINKING WATER FROM THE IVER RHINE,
iwa Ltd., Rijswijk (Netherlands).
. Poels.
Vater SA, Vol 6, No 1, p 15-20, January, 1980. 2 ig, 4 Tab, 9 Ref.

escriptors: *Potable water, *Toxins, *Fish physi-ogy, Aromatic compounds, Water pollution, ublic health, Water quality, Fish, Rivers, *Rhine iver(Netherlands).

he suitability of Rhine water for the preparation f drinking water was examined in four experi-ents. Experiment A determined the chronic toxic uality of Rhine water and its effects on rainbow out. Experiment B determined that the mortality f rainbow trout eggs was higher in Rhine water, nd that the water was acutely toxic to juvenile out. Experiment C, on the induction of cytoge-etic effects of Rhine water in fish, found evidence at strongly suggests the Rhine water contained ubstances which were able to induce chromosome reaks in the gills of the eastern mudminnow. xperiment D, on the induction of mutations in acteria by Rhine water, found that aromatic hy-rocarbon fractions increased the number of muta-ons. The significance of these results to the prepa-ation of Rhine water for drinking by humans is ot yet known. (Small-FRC)
V81-01753

IARINE SOFT-BOTTOM BENTHIC COMMU-ITY OFFSHORE FROM BLACK ROCK EWAGE OUTFALL, CONNEWARRE, VICTO-IA,
Ielbourne University, Parkville (Australia), Dept. f Zoology.
. H. Dorsey, and R. N. Synnot.
ustralian Journal of Marine and Freshwater Re-earch, Vol 31, No 2, p 155-162, April, 1980.

escriptors: *Crustaceans, *Benthic fauna, *Out-ll sewers, Water pollution effects, Outlets, Black ock Outfall, Polychaetes, Aquatic life, Marine imals, Nitrates, Phosphates, Nutrients, Sewage, lgae, Sediments, Plankton, Amphipoda, Victoria, ustralia.

rustaceans and polychaetes dominated the in-unal species in the offshore benthic community at lack Rock Sewage Outfall, Victoria, Australia. hese animals have also been seen in high counts a sewage drain in the Port Phillip Bay area. ewage contributes both organic particulates and utrients that stimulate the growth of benthic uni-ellular algae. These materials plus plankton are a uitable food supply for the observed animals, hich are detritus and suspension feeders. The abitat is basically uniform, fine-grained, sandy ediment which generally supports fewer species an a less homogeneous sediment. (Cassar-FRC)
V81-01778

APID INDUCTION OF COPPER-BINDING ROTEINS IN THE GILLS OF METAL EX-OSED MUSSELS,
enoa Univ. (Italy). Ist. di Fisiologia Generale.
. Viarengo, M. Pertica, G. Mancinelli, G.
anicchi, and M. Orunesu.
omparative Biochemistry and Physiology C, Vol 7, No 2, p 215-218, 1980. 4 Fig, 14 Ref.

escriptors: *Mussels, *Copper, *Water pollution ffects, Gills, *Proteins, Trace elements, Metals, oxicity, Metallothioneins, Aquatic animals.

lussels synthesized low molecular weight (12,000) oluble copper-binding proteins similar to metal-othioneins in gill tissue as a response to sublethal opper concentrations (0.08 ppm) for 24 to 48 ours. Evidence that these proteins are neosynthe-zed was obtained by injecting S35 labeled sys-eine into the posterior adductor muscle 7 hours efore death in a 48 hour exposure. Compared ith controls, cystein incorporation into the 12,000 olecular weight copper-rich fraction was 7 to 10 mes greater, whereas it decreased in the high olecular weight soluble proteins. In addition, the ulfhydryl group concentration in these proteins was increased by 5 or 6 fold compared with controls. (Cassar-FRC)
W81-01785

CHIRONOMIDAE COMMUNITIES OF THE RIVER NIDA AND ITS TRIBUTARIES,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
K. Srokosz.
Acta Hydrobiologica, Vol 22, No 2, p 191-215, 1980. 10 Fig, 5 Tab, 83 Ref.

Descriptors: *Nida River(Poland), *Diptera, *Dominant species, *Water pollution effects, *Rivers, *Biological communities, Aquatic animals, Aquatic insects, Poland, Tributaries, Self-purification, Water purification, Habitats, Aquatic habitats.

The distribution and structure of Chironomidae communities in the River Nida (Poland) and its tributaries was studied on 17 dates at 11 stations during 1973-1975. Municipal and industrial wastes in the middle sector of the river system decreased the number of specimens and disturbed the domination structure. Tubificidae prevailed in polluted waters, while Naididae occurred in pure waters. At some stations in the polluted section a domination structure did not develop at all. As self-purification improved conditions downstream, domination structuures again appeared. In all, 148 taxonomic units were identified. (Cassar-FRC)
W81-01790

CHEMICAL COMPOSITION OF RECENT BOTTOM SEDIMENTS OF THE LAKE ZAGNANIE,
Akademia Rolniczo-Techniczna, Olsztyn-Kortowo (Poland). Inst. of Hydrobiology and Water Conservation.
For primary bibliographic entry see Field 5B.
W81-01791

INFLUENCE OF A SUBMARINE MUNICIPAL OUTFALL ON SURROUNDING BENTHIC ECOSYSTEM (PROCCHIO, ISLE OF ELBA, ITALY),
Genoa Univ. (Italy). Inst. di Anatomia Comparata.
R. Cattaneo, G. Polleri, and P. Pericoli.
Progress in Water Technology, Vol 12, No 1, p 163-184, 1980. 5 Fig, 3 Tab, 13 Ref.

Descriptors: *Outfall sewers, *Benthic fauna, *Sewage, *Bioindicators, *Bays, Ecosystems, Sedimentology, Water pollution effects, Aquatic life, Europe, Isle of Elba, Italy.

The distribution of the Bryozoa population (Cheilistomata) in a bed of posidonia along the coast of the Isle of Elba close to a small sewage outfall was studied. During the two years of the study, random samples were taken from the leaves and rhizomes of Posidonia oceanica, and the sediments under the beds were evaluated by oxidation with H2O2. The bryozoological populations in the posidonia beds were stable over the study period. An attempt was made to relate the type of fauna with the type of sediment, but without useful results. Two years of a small sewage discharge was not sufficient to alter the ecology of the bay. The research did reveal the complexity of the benthic ecosystem. Seventeen Anasca and 29 Ascophora were found. Also, within the bed there were two different populations, corresponding to the deepest and shallowest areas, both for the bryozoa present on the rhizomes and for those on the leaves. (Small-FRC)
W81-01803

LIMING ACID LAKES IN SWEDEN,
National Board of Fisheries, Goeteborg (Sweden).
For primary bibliographic entry see Field 5G.
W81-01814

TOXICITY OF LANDFILL LEACHATES,
Babichuk Construction Ltd., Calgary (Alberta).
R. D. Cameron, and F. A. Koch.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 760-769, April, 1980. 5 Fig, 7 Tab, 14 Ref.

Descriptors: *Toxins, *Leachate, *Landfills, Bioassay, Rainbow trout, Water analysis, Filtration, Coagulation, Lime, Ammonia, Copper, Hydrogen ion concentration, Toxicity.

Landfill leachate toxicity was reviewed by examining the results of several studies on natural leachates and synthetic leachates. Most toxicity analyses were conducted at independent testing laboratories using either the standard static 96-hour bioassay or the residual oxygen bioassay technique. Rainbow trout were the test organism in all experiments. Leachate toxicity varied over a wide range: from less than 16% to 100%. When leachates were treated by filtration through columns of natural peat or by lime coagulation followed by peat filtration, leachates were non-toxic. Most pollutants were reduced 85 to 99% by the two treatment processes. Over 94% of the observed toxicity was explained by un-ionized ammonia, tannin, copper, and hydrogen ion concentration. All natural leachates tested were found to be highly toxic within the confines of the landfill and usually after stream discharge. (Small-FRC)
W81-01828

EFFECTS OF HEATED EFFLUENT ON THE REPRODUCTIVE BIOLOGY OF WHITE CRAPPIE, POMOXIS ANNULARIS IN CONOWINGO POND, PENNSYLVANIA,
Radiation Management Corp., Drumore, PA. Muddy Run Ecological Lab.
D. Mathur, and P. L. McCreight.
Archiv fur Hydrobiologie, Vol 88, No 4, p 491-499, June, 1980. 2 Fig, 12 Ref.

Descriptors: *Nuclear powerplants, *Thermal pollution, *Fish reproduction, *Sunfishes, Gonads, Spawning, On-site investigations, Ponds, Pennsylvania.

The effects of heated effluent from the Peach Bottom Atomic Power Station on the reproductive biology of fishes, including altered spawning time and abnormal development and hatching of eggs, were examined. The water temperature in the plume averaged 5.6 to 11.1 degrees C above the ambient temperature. There was some variation in the gonosomatic index of fish, but the reproductive cycle remained similar to other years. Other researches have found some indication of interruption and biomodality in spawning of fish exposed to heated waters. In this study there was no evidence of earlier spawning in the thermal plume, using gonosomatic ratios and larval fish catches as indicators. Temperature at peak spawning was similar to other years and other areas. The gonosomatic ratios of crappie collected in the thermal plume were slightly lower than those from ambient areas. The gonosomatic ratio equals the weight of the ovaries divided by the weight of the fish minus the weight of the ovaries, times 100. (Small-FRC)
W81-01833

PARAMETRIC ANALYSES OF MORTALITY RATES IN BIOASSAYS,
Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Delft (Netherlands).
S. A. L. M. Kooijman.
Water Research, Vol 15, No 1, p 107-119, January, 1981. 7 Fig, 12 Tab, 15 Ref.

Descriptors: Mathematical models, *Bioassay, Toxicity, *Mortality, Toxins, Water pollution, Water pollution effects, Model studies, *Aquatic life, Sampling, Metabolism, Pesticide residues, Theoretical analysis.

Some parametric analyses of results of several bioassays in which several groups of organisms are exposed to a range of concentrations of test compounds are described. The main application of the analyses is in aquatic toxicity tests, although they sometimes may be useful in mammalian toxicology studies. The theory presented is based on the principle of maximum likelihood, and the concentrations of toxins are chosen so that at least one group

of organisms suffers significant but not excessive mortality. A large sample technique is employed to mathematically estimate the no effect level, the small effect level and the ultimate effect level of the test compound. The relevance of LC50 values in toxicity tests and hazard evaluations is considered. Procedures for the determination of accumulation and elimination behavior of test compounds through mortality information are given. A method is outlined for calculating the disappearance rate of a test compound in a semistatic bioassay from the mortality rates of the test species. The theory has been applied to toxicity tests on various aquatic species using cupric chloride, cadmium chloride, pentachlorophenol, 1,2,3-trichloropropane, para-chlorophenol and an industrial waste (DSB) as aquatic pollutants. (Geiger-FRC)
W81-01861

PRODUCTION OF UREA BY BACTERIAL DECOMPOSITION OF ORGANIC MATTER INCLUDING PHYTOPLANKTON,
Yamagata Univ. (Japan). Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W81-01866

A FISH-KILL IN HEART LAKE, ONTARIO, ASSOCIATED WITH THE COLLAPSE OF A MASSIVE POPULATION OF CERATIUM HIRUNDINELLA (DINOPHYCEAE),
Ontario Ministry of the Environment, Rexdale. Limnology and Toxicity Section.
K. H. Nicholls, W. Kennedy, and C. Hammett.
Freshwater Biology, Vol 10, No 6, p 553-561, December, 1980. 4 Fig, 28 Ref.

Descriptors: *Fishkill, *Destratification, *Water pollution effects, *Eutrophication, Ceratium hirundinella, Dinoflagellates, *Heart Lake(Ontario), Anaerobic conditions, Fish harvest, Aeration, Stratification, Aquatic algae, Recreation, Chlorophyta, Phytoplankton, Dissolved oxygen, Lakes, Limnology, Zooplankton, Canada.

During early August, 1976, a population of the dinoflagellate, Ceratium hirundinella, grew to a maximum level of 53 cu mm per liter in waters of Heart Lake, Ontario, a recreational lake which experienced blooms of blue-green algae. The lake has a history of enrichment from nearby duck farms. Artificial destratification by aeration was done for about 6 months beginning in June 1975 and again starting in April 1976. This process effectively inhibited algal bloom, but promoted oxidation and mineralization of organic matter on the lake bottom, raising levels of total phosphorus, soluble phosphorus, and organic nitrogen. These nutrients, the lack of competition from other algae, and the absence of organisms to feed on these larger cells permitted the dinoflagellates to grow rapidly. The biomass collapsed suddenly, causing oxygen depletion and killing more than 600 fish--rainbow trout, black bass, and bullheads. It is believed that inorganic nitrogen depletion started the collapse, which accelerated rapidly as decomposing cells depleted dissolved oxygen. (Cassar-FRC)
W81-01868

ABNORMALITIES IN THE TRACHEAL GILLS OF AQUATIC INSECTS COLLECTED FROM STREAMS RECEIVING CHLORINATED OR CRUDE OIL WASTES,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
K. W. Simpson.
Freshwater Biology, Vol 10, No 6, p 581-583, December, 1980. 1 Fig, 18 Ref.

Descriptors: *Aquatic insects, *Water pollution effects, *Oil pollution, Chlorine, Gills, Stoneflies, Caddisflies, New York, Allegheny River(New York), Gooseberry Creek(New York), Treatment facilities, Streams.

Aquatic insects collected in two streams in New York State showed tracheal gill alterations. At Gooseberry Creek, downstream from a treatment plant discharging chlorinated effluent, branches were absent or incomplete in gills in stonefly nymphs. Caddisfly larvae were greatly reduced in number, and 10 of 12 specimens had damaged gills. Sampling in the Allegheny River, which has a history of crude oil contamination, yielded 18 out of 40 caddisfly specimens with tar specks on their gills and 6 with completely tarred gills. All damaged specimens were smaller than normal and were living in water with high dissolved oxygen concentration. It is not known whether these individuals could have successfully completed their life cycles. Tracheal gill changes may be useful for documenting effects of toxic materials on freshwater fauna. (Cassar-FRC)
W81-01869

INORGANIC PHOSPHATE UPTAKE IN A BRACKISH TROPICAL LAGOON,
Office de la Recherche Scientifique et Technique Outre-Mer, Abidjan (Ivory Coast). Centre de Recherches Oceanographiques.
L. Lemasson, J. Pages, and J-L. Cremoux.
Estuarine and Coastal Marine Science, Vol 11, No 5, p 547-561, November, 1980. 9 Fig, 3 Tab, 41 Ref.

Descriptors: *Phosphates, *Ebrie Lagoon(Ivory Coast-Africa), *Nutrients, *Absorption, Aquatic microorganisms, Light intensity, Brackish water, Phosphorus compounds, *Lagoons, Ivory Coast(Africa), Bacteria, Phytoplankton, Aquatic environment, Photosynthesis, Seston, Water pollution effects, Sewage, Tropical regions.

The effect of light on phosphate uptake by aquatic microorganisms was studied in Ebrie Lagoon, Ivory Coast, West Africa. This body of water, about 550 sq km in area and with a mean depth of 3 meters, experiences tidal intrustions and sewage discharges from a city of 1 million. Phosphate uptake varied at the different stations sampled, but was classified into 3 general groups: light uptake differed from dark uptake and followed light variations; uptake was stimulated by light, but did not follow its variations; and light uptake equaled dark uptake. Phosphate uptake showed a 24 hour rhythm, with the highest uptake in the early morning and the lowest in the late afternoon. The maximum phosphate uptake rate was independent of light intensity when light energy was higher than a limit value. Phosphate uptake appeared to depend on the depletion of dissolved inorganic phosphate and on the ATP concentration in the seston. Two examples of luxury uptake of carbon were observed in a nutrient depleted station, and 1 case of luxury phosphate uptake was seen during phosphate excess. (Cassar-FRC)
W81-01871

ON THE BENTHIC FAUNA OF SOME RIVER SYSTEMS IN NAGASAKI DISTRICT (4). THE SASU AND THE SE RIVERS OF TSUSHIMA IN SUMMER (IN JAPANESE),
Nagasaki Prefecture Inst. of Health Science and Environmental Science (Japan).
S. Ishizaki, and Y. Machida.
Japanese Journal of Limnology, Vol 41, No 1, p 19-23, January, 1980. 3 Tab, 11 Ref.

Descriptors: *Mine wastes, *Water pollution effects, *Benthic fauna, *Mayflies, Diptera, Metals, *Nagasaki, Japan, Se River(Japan), Sasu River(Japan), Zinc, Aquatic life, Heavy metals, Rivers, Seasonal.

Discharge from a zinc mine affected the benthic fauna in the Sasu River in winter. In summer, numbers of individuals and species increased, the heavy metals content of the water increased, and the heavy metals in the mud decreased. Predominant fauna were Ephemeroptera in summer and Chironomidae in winter. In the Se River, the dominant species in winter and summer were the reverse of those in the Sasu River. All sampling stations showed rich animal life in summer and winter. However, the patterns of species observed changed from season to season. (Cassar-FRC)
W81-01874

TOXICITIES OF MICROCYSTIS AERUGINOSA COLLECTED FROM SOME LAKES, RESERVOIRS, PONDS AND MOAT IN TOKYO AND ADJACENT REGIONS,
Tokyo Metropolitan Research Lab. of Public Health (Japan).
M. F. Watanabe, and S. Oishi.
Japanese Journal of Limnology, Vol 41, No 1, p 5-9, January, 1980. 5 Tab, 10 Ref.

Descriptors: *Algae, *Toxicity, *Eutrophication, Water pollution effects, Cyanophyta, Microcystis aeruginosa, Surface waters, Tokyo, *Japan, *Lakes, Reservoirs, Ponds, Aquatic algae, Algal toxins, Potable water.

Microcystis aeruginosa, a blue-green alga observed in eutrophied waters, was harvested from lakes, reservoirs, ponds, and moats in and near Tokyo. Mice were injected intraperitoneally with 0.2 ml of the crude, heat-treated algae extracts and with extracts treated to destroy protein components. Crude algae extracts from 5 of 10 bodies of water caused death in mice in 1 to 2 hours. Toxicity was decreased by pepsin treatment of the extracts and eliminated by trypsin treatment, suggesting that the toxin is a heat-stable peptide or protein. In a dilution test 50 mg per ml was the minimum lethal dose, corresponding to 330-400 mg per kg. (Cassar-FRC)
W81-01876

RESOLUTION OF AN INDUSTRIAL WASTE DILEMMA,
Quicksall (W. E.) and Associates, Inc., New Philadelphia, OH.
J. R. Morgan.
Public Works, Vol 111, No 8, p 57-59, August, 1980. 3 Fig.

Descriptors: *Nitrates, *Industrial wastes, *Sludge, Treatment facilities, *Skimming, Performance, Waste water treatments, *Floating sludge, Rubber extrusion, Curing agent.

Problems with floating sludge caused by an unknown industrial waste caused BOD and suspended solids removal levels to deteriorate at the waste water treatment facility at New Philadelphia, Ohio. The amount of floating sludge in the primary clarifiers was much greater in the summer months, but the process was more seriously affected during the winter months. Manual skimming was the only way to really remove the floating sludge. Excess nitrates, higher than 1000 mg/liter in the influent, seemed to be the cause of the sludge. The trunk sewer area responsible for the excess nitrates was located and the offender was found to be a small rubber extruding industry. Potassium nitrate was used as a curing agent in the extrusion process. Initial efforts of the industry to control nitrate levels were not very successful. When the industry attempted to recover the salt, not only was the floating sludge problem solved, but the industry saved $20,000 per year. (Small-FRC)
W81-01879

FINDING THE RIGHT RX FOR TASTES AND ODORS,
York Water Co., PA. Purification Dept.
For primary bibliographic entry see Field 5F.
W81-01894

EXPERIMENTAL ACIDIFICATION OF A STREAM IN THE HUBBARD BROOK EXPERIMENTAL FOREST, NEW HAMPSHIRE,
Cornell Univ., Ithaca, NY. Div. of Biological Sciences.
R. J. Hall, G. E. Likens, S. B. Fiance, and G. R. Hendrey.
Ecology, Vol 61, No 4, p 976-989, August, 1980. 6 Fig, 3 Tab, 62 Ref.

Descriptors: *Acid streams, *Precipitation(Atmospheric), *Environmental effects, *Ecosystems, Acidic water, Ecosystems, Hydrogen ion concentration, On-site investigations, Diptera, Mayflies, Aquatic fungi, Water chemistry.

To simulate the effects of the increased acidity of rain on an ecosystem, dilute concentrations of sulfuric acid were added to Norris Brook, a stream in the Hubbard Brook Experimental Forest, West

Thornton, New Hampshire. The stream was maintained at pH 4 from April to September 1977. With increased acidity, stream water concentrations of the following were elevated: Al, Ca, Mg, K, and probably Mn, Fe, and Cd. There was decreased emergence of adult mayflies (Ephemeroptera), some stoneflies (Plecoptera), and some true flies (Diptera). The number and diversity of aquatic insects in collector, scraper, and predator functional groups decreased in drift. Aquatic hyphomycetes decreased, but the fungal community and periphyton biomass increased. Thus, the biotic structure, metabolism, and biogeochemistry of the stream ecosystem were altered at a pH level commonly found in precipitation. These findings are consistent with the hypothesis that heterotrophs may control biomass and primary production of attached plants in stream ecosystems by increasing energy transfer between primary and secondary trophic levels. (Small-FRC)
W81-01900

5D. Waste Treatment Processes

EVALUATION OF 19 ON-SITE WASTE TREATMENT SYSTEMS IN SOUTHEASTERN KENTUCKY,
Parrott, Ely, and Hurt, Lexington, KY.
J. L. Abney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-111015, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-101, July, 1980. 83 p, 18 Fig, 15 Tab, 15 Ref, 2 Append. CA-8-2575-A.

Descriptors: *Sewage disposal, *Rural areas, *Kentucky, *Sewage treatment, Prototypes, Septic tanks, Incineration, Soil properties, Operation and maintenance, Costs, Recycling, Safety, Public health, Social aspects, Performance, Incinerating toilets, Recycling toilets, Extended aeration tanks.

In 1970, many of the homes in rural Southeastern Kentucky were lacking adequate sanitary facilities for the disposal of human wastes. Shallow soils, steep slopes, and high groundwater levels made it difficult to provide sanitary wastewater disposal systems at a reasonable cost. Forty to sixty percent of the households had annual incomes of less than $3,000 in 1969. This report provides a summary of the design, installation, operation and maintenance, performance, and costs of nineteen prototype on-site systems installed in 1970-72. These systems included electric and gas-fired incinerating toilets, recycling toilets, extended aeration units followed by open sand filters, septic tanks followed by open sand filters, septic tanks followed by horizontal sand filters, and septic tanks followed by soil absorption trenches. In addition, the alternatives are evaluated against a set of criteria which includes user acceptance, health protection, safety energy requirements, longevity, frequency of maintenance, and capital and operation/maintenance costs. The septic tank-soil absorption systems were found to have the lowest cost and highest level of performance. Where suitable soils are located or can be economically imported, this would be the preferred system. (Moore-SRC)
W81-01681

AN ECONOMIC ANALYSIS OF EFFLUENT STANDARDS FOR BOD, AMMONIA, TOTAL SUSPENDED SOLIDS, AND DISINFECTION: CASE STUDY OF A MODERN TREATMENT PLANT,
Donald L. Hey and Associates, Chicago, IL.
D. L. Hey, J. M. Pappas, and L. C. Cox.
Illinois Institute of Natural Resources Document No 80/25, November, 1980. 46 p, 3 Fig, 22 Tab, 24 Ref.

Descriptors: *Waste water treatment, *Operating costs, *Treatment facilities, *Variable costs, Alternative planning, Analysis, Biochemical oxygen demand, Municipal wastes, Waste treatment, Waste water(Pollution), Waste water disposal, Water pollution, Water pollution treatment, Costs, Water management(Applied), Water quality control, Cost analysis, Economic efficiency, Ammonia, Suspended solids, Effluents, Standards.

Stricter effluent limits have economic effects in both capital and operating costs. Variable effluent limits will require the same capital facilities as fixed limits, but cost analysis of the Downers Grove treatment plant showed that operating cost for variable limits would be 21% less ($266,000 less) than for fixed limits. Controlling BOD variably (following the seasonal standards) would account for 12% ($33,000) of the savings; seasonal nitrification, 39% ($104,000); and elimination of chlorination, 44% ($108,000), saving 1.87 million kilowatt hours in the process. Reasons are given for the observation that the return on investment in variable (or fixed) effluent limits is uncommensurate with the operating or facility costs. It is recommended at maximum that variable limits be used to regulate the quality of treatment plant effluents. An alternate to variable limits operation would be instream treatment, operated on a regional scale, which, if deemed beneficial, would be less costly than nitrification facilities construction at all tributary plants, and would offer low-cost determination of water quality limitations to propagation of desirable aquatic organisms. (Zielinski-IPA)
W81-01701

THE PRESENT STATE OF POLLUTION CONTROL TECHNOLOGY FOR THE FISHING INDUSTRY,
Fisheries and Marine Service, Vancouver (British Columbia). Vancouver Lab.
F. G. Claggett.
In: Pollution and the Fisheries: Proceedings, 27th Annual Meeting of the Fisheries Council of Canada, Environmental Protection Service Report No EPS 3-WP-73-4, August, 1973, p 22-27.

Descriptors: *Fisheries, *Water pollution sources, *Water pollution treatment, *Canada, *Water pollution control, *Costs, Decontamination(Water), Treatment, Flotation, Filtration, Abatement, Application equipment, Biodegradation, Pollutants, Sewage treatment, Water pollution sources, Control, Industrial production, Alternative costs, Construction costs.

In light of developing environmental standards, four questions were discussed concerning the Canadian fishing industry: (1) are we polluting; (2) if so, to what extent, and what are the pollutants; (3) how much must be removed to meet the standards; and (4) which is the least expensive method. Answers to the first two questions are: yes, most of the larger plants are probably polluting; among the pollutants are fish particles, oil, blood, and slime which exert a biological oxygen demand on the receiving waters. The least degree of treatment demand will be physical removal of insoluble solids. Tangential screens can reduce the solids load by 50% after prescreening by trommel screens. A full-scale demonstration plant to treat waste water from fishing plants concentrates solids from 300,000 gallons/day into 6000 gallons of sludge, reducing the pollution load 80%. Further treatment alternatives are (1) waste water discharge to the municipal sewer system, or (2) use of an aerated lagoon. Tangential screen cost ($6000) can be recovered in two years; a 500 gallon/minute treatment plant costs about $75,000, and 15-25 cents/1000 gallons to operate; municipal sewer use (moderate size salmon canning plant), about $75/day user charges; a five-acre lagoon, $35,000, and about 8 cents/1000 gallons to operate. (Zielinski-IPA)
W81-01706

ENTEROVIRUS AND COLIPHAGE INACTIVATION DURING ACTIVATED SLUDGE TREATMENT,
New Mexico State Univ., Las Cruces. Dept. of Biology.
J. S. Glass, and R. T. O'Brien.
Water Research, Vol 14, No 7, p 877-882, July, 1980. 2 Fig, 6 Tab, 14 Ref. OWRT-A-052-NMEX(9).

Descriptors: *Viruses, *Bacteriophages, *Activated sludge, *Sludge treatment, Laboratory tests, Waste water treatment, Disinfection, Mathematical studies, Adsorption, Bioindicators, Model studies, Pilot plants.

The inactivation rates of enteric viruses and coliphages in a large volume activated sludge unit at New Mexico State University were examined in pilot plant studies. The fraction of total virus removed that was attributed to inactivation was also examined. Poliovirus 1, coxsackievirus B-1 and indigenous coliphage inactivation closely resembled first order kinetics with inactivation rates which were not dependent on flow rates of the mixed liquor. No significant differences were found between the enterovirus and coliphage inactivation rates indicating that phage inactivation might be used as an indicator for enterovirus inactivation during activated sludge treatment. Determinations were made of total virus removal from mixed liquor and an overall average rate constant for phage and virus inactivation was calculated. A plot of percent virus survival versus hours of exposure to activated sludge treatment was also generated. (Geiger-FRC)
W81-01708

CAPACITY OF ACTIVATED SLUDGE SOLIDS FOR VIRUS ADSORPTION,
California Univ., Los Angeles. Dept. of Chemical, Nuclear and Thermal Engineering.
V. L. Vilker, R. S. Kamdar, and L. H. Frommhagen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127210, Price codes: A04 in paper copy, A01 in microfiche. Chemical Engineering Communications, Vol 4, p 569-575, 1980. 3 Fig. (California Water Resources Center Project UCAL-WRC-W-523). OWRT-B-184-CAL(6).

Descriptors: *Waste water treatment, *Viruses, *Water reuse, *Activated sludge, Soil testing, Soil properties, Adsorption, Biological treatment.

The first significant reduction in wastewater virus concentration occurs in the biological treatment process, either by removal of solid matter in which virus is embedded or by adsorption of virus to the biomass. In addition, the effectiveness of subsequent disinfection and the ultimate fate of treatment plant effluent virus are dependent on the extent of virus association with small suspended particles. This report is a study of adsorption of Type I poliovirus to solids collected from an activated sludge unit and resuspended in filtered final effluent. Virus adsorption capacity was correlated by an isotherm relationship which includes the effect of decreasing capacity with increasing solids concentration. This effect is probably caused by decreased solids surface area due to solids aggregation. The results indicate smaller capacity at typical activated sludge mixed liquor solids concentration than would be predicted from previous studies, and that only about 20% of total virus are absorbed at low solids concentration typical for treatment plant effluent. (Snyder-California)
W81-01710

PROCESS FOR REMOVING SULFATE IONS FROM AQUEOUS STREAMS,
Du Pont de Nemours and Co., Wilmington, DE. (Assignee).
J. L. Balmat.
U.S. Patent No 4,200,523, 6 p, 1 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1744, April 29, 1980.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, Sulfates, Anaerobic conditions, Sulfur bacteria, Recycling.

Sulfate ions contained in aqueous streams essentially free of organic carbon such as sulfuric acid streams are converted into more recoverable form by subjecting the stream to the action of sulfate-reducing bacteria in an inorganic, anaerobic system in the presence of an excess of calcium carbonate and converting the resultant sulfide ions into an undissolved vapor or solid phase to facilitate recovery. (Sinha-OEIS)
W81-01713

BIO-SURFACE SEPARATION PROCESS,
Biospherics Inc., Rockville, MD. (Assignee).
G. V. Levin.
U.S. Patent No 4,200,524, 5 p, 1 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1745, April 29, 1980.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Separation techniques, Aeration, Biological treatment, Activated sludge, Microorganisms, Bio-surface particulates.

An activated sludge sewage treatment process comprises mixing influent sewage material with activated sludge and bio-surface particulates to provide a mixed liquor. The mixed liquor is passed to an aeration zone where it is contacted with an oxygen-containing gas to reduce the BOD content. The mixed liquor is then passed to a settling zone to separate bio-surface particulates having sludge particles adherent and a clarified supernatant. The clarified supernatant is removed from the settling zone and is discharged as effluent or routed for further treatment. At least a portion of the bio-surface particulates having adherent sludge is subjected to a treatment to separate at least of portion of the adherent sludge particles. The treated portion is then passed to a bio-surface particulate sludge separator. In this separator, the sludge present in the mixture which is not adherent to the bio-surface particulates separates and is passed out of the system as waste sludge. The bio-surface particulates and remaining sludge are then recycled for mixing with influent sewage material. (Sinha-OEIS)
W81-01714

PROCESS FOR TREATING WASTE WATER,
Gerber Products Co., Fremont, MI. (Assignee).
E. W. Johnson, M. J. Reider, R. Anewalt, and H. J. Kring.
U.S. Patent No 4,300,526, 6 p, 2 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1745, April 29, 1980.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, *Reverse osmosis, Reduction(Chemical), Flocculation, Filtration, Textiles, Fibers(Plant), Recycling.

Reverse osmosis treatment of the waste effluent from a textile plant is rendered feasible by first removing from the raw effluent as much of the pollutants as possible. After preliminary filtering to remove foreign particles, the waste water is treated with a reducing agent, if needed, and the pH adjusted to 8.0-9.5. The waste water is then treated with a flocculating agent. After further treatment in a clarifier, the waste water is passed through a sand filter to remove any residual suspended solids. The pH is adjusted to below about 6.0 and the waste water is then subjected to reverse osmosis. Approximately 90% of the raw effluent water has been found to be recovered for recycling. (Sinha-OEIS)
W81-01715

REMOVING METAL IONS FROM AQUEOUS EFFLUENTS,
PQ Corp., Valley Forge, PA. (Assignee).
V. J. Cassella, and M. R. Irani.
U.S. Patent No 4,200,528, 6 p, 1 Fig, 5 Tab, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1746, April 29, 1980.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, Ions, Metals, Chemical reactions, Tannery wastes, Chromium, Magnesium compounds, Product recovery.

The invention provides a method for removing various metal ions before waste effluents are released to the environment. Most particularly, the invention relates to removing and recovering chrome values from tanning effluents. Amorphous, hydrated magensium silicate is mixed with aqueous effluent. The slurry of magnesium silicate in the effluent is heated and/or adjusted in pH if desired. The metal ions (90% or more) are complexed by the silicate and effectively removed from the effluent by filtering off the silicate. The slurry of silicate and chrome tanning effluent is adjusted to and/or maintained at a pH of 5.3 to 9.8 to attain more than 90% removal of tri-valent chromium ions. Large proportions of the complexed metal ions can be recovered by acid treatment of the filtered material. (Sinha-OEIS)
W81-01716

APPARATUS FOR RENOVATION OF SANITARY WATERS,
F. Besik.
U.S. Patent No 4,200,534, 6 p, 1 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1748, April 29, 1980.

Descriptors: *Patents, *Waste water treatment, *Domestic wastes, Aeration, Suspended solids, Chemical reactions, Oxidation, Equipment.

A selfcontained apparatus for on-site renovation of sanitary waters is comprised of three aeration chambers. They are: a mineral storage and dispensing container, a submerged suspended solids separator located in the third aeration chamber, a flow equalizer, a chemical oxidizing agent dispensing system, a chemical oxidation-clarification chamber and a charcoal containing chamber, all enclosed in a single tank designed for use on land as a single or multiple family waste water renovation system, or off-shore as a marine sanitation device. (Sinha-OEIS)
W81-01717

METHOD AND APPARATUS FOR THE ENHANCED TREATMENT OF FOOD PROCESSING WASTE WATERS USING AEROBIC MICROORGANISMS,
D. A. Rollag, J. N. Dornbush, and R. C. Renner.
U.S. Patent No 4,201,663, 5 p, 2 Fig, 18 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 248, May 6, 1980.

Descriptors: *Patents, *Waste water treatment, *Organic wastes, *Food processing industry, Odor, Gases, Aerobic bacteria, Absorption, Adsorption, Biodegradation, Microorganisms.

The severe odor problem which is inherent in the anaerobic lagoon treatment method to purify the waste waters from meat, poultry, and other food processing plants, greatly limits the possible locations for treatment sites and creates a severe environmental problem. Accordingly a general object of this invention is to provide an improved method and apparatus for aerobic bacterial decomposition of odorous gases generated by the anaerobic bacteriological decomposition of organic liquids to thereby minimize the odor problem inherent in prior art anaerobic lagoon treatment processes. The process uses a plastic film to support an air transport system and a blanket of inexpensive biodegradable material which provides the functions of heat insulation, odor absorption/adsorption and mechanical support for attached aerobic microorganisms which act to decompose odorous gases. (Sinha-OEIS)
W81-01722

ULTRAFILTRATION OR REVERSE OSMOSIS TREATMENT OF EMULSIFIED OIL METAL WORKING COOLANTS,
Continental Group, Inc., New York. (Assignee).
I. M. Hekal.
U.S. Patent No 4,201,664, 5 p, 1 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 249, May 6, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Separation techniques, Reverse osmosis, Emulsions, Oil wastes, *Oily water, Ultrafiltration, Product recovery.

A portion of the oil-in- water emulsion used as a lubricant/coolant in the shaping of metal articles such as containers is subjected to a reverse osmosis or ultrafiltration process to concentrate the oil portion and separate a water permeate. The oil concentrate is reincorporated in the remaining portion of the coolant and the permeate is used as rinse water to remove oil residues retained on the article from the metal shaping operation. The coolant is then reconstituted with the oil residue rinsed from the article. By using permeate derived from the coolant for the rinsing and then reconstituting the coolant with the effluent collected from the permeate rinsing of the article, the oil normally lost with the disposal of rinse water is recovered and the water disposal problem associated with such effluent is substantially eliminated. The presence of surfactant in the permeate rinse water provides the additional advantage that the surfactant promotes the removal of the adhered oil from the metal article being rinsed. (Sinha-OEIS)
W81-01723

USE OF NONSTOICHIOMETRIC CARBON SULFUR COMPOUNDS TO REMOVE COMPONENTS FROM LIQUIDS,
Exxon Research and Engineering Co., Florham Park, NJ. (Assignee).
For primary bibliographic entry see Field 5G
W81-01724

TREATING PULP-AND-PAPER MILL STREAMS,
Sprague Electric Co., North Adams, MA. (Assignee).
J. A. Newton.
U.S. Patent No 4,201,666, 3 p, 2 Tab, 11 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 249, May 6, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Pulp and paper industry, Chemical wastes, polyelectrolytes, Flocculation, Color, Sedimentation.

Aqueous pulp-and-paper mill waste streams are treated with a waste stream derived from the nitric acid etching of aluminum foil for electrolytic capacitors. This waste stream consists essentially of aqueous acidic aluminum nitrate, and a polyelectrolyte is added to it to synergistically improve flocculation, settling, and dosage rates. One of the purposes of this invention is the utilization of one waste stream to treat another waste stream, thereby simplifying the disposal of each and reducing chemical requirements. (Sinha-OEIS)
W81-01725

PROCESS FOR REMOVING ARSENIC FROM AQUEOUS MEDIUMS,
FMC Corp., Philadelphia, PA. (Assignee)
H. P. Liao.
U.S. Patent No 4,201,667, 7 p, 11 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 249, May 6, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Separation techniques, Chemical precipitation, *Arsenic compounds, Phosphorus, Hydrogen ion concentration.

An improved process for treating an aqueous, arsenic-containing medium provides for the rapid removal of the major portion of arsenic, and also minimizes residual arsenic which may normally be present as water-soluble compounds. The process comprises incorporating into an aqueous, arsenic containg medium, and in the presence of phosphorus, sufficient calcium hydroxide ($Ca(OH)_2$) to adjust the aqueous medium to a pH of from 7.0 to 11.5, thereby causing both the arsenic and phosphorus to precipitate, and thereafter separating the precipitates. Residual concentrations of arsenic and phosphorus, which are in lower oxidation states and thus are normally present as water-soluble compounds, are minimized by the oxidation with chlorine, preferably before the addition of the $Ca(OH)_2$, to more insoluble compounds which are separated as precipitates from the aqueous medium. (Sinha-OEIS)
W81-01726

PROCESS AND DEVICE FOR THE AERATION OF WASTE WATER,
Stamicarbon, B. V., Geleen (Netherlands). (A

ignee).
?. J. Fontein, and H. F. Jennekens.
J.S. Patent No 4,202,762, 10 p, 4 Fig, 2 Tab, 7 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 623, May 13, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Biological treatment, Aeration, Activated sludge, Equipment, Jets, Circulation.

Waste water containing suspended biologically active sludge and circulating in an endless path in a vessel is aerated by withdrawing a stream of the water and recycling it to the vessel in the form of downwardly directed jets which penetrate the water surface and thereby entrain air in the water. The jets are directed onto the water surface at an angle of less than 60 degrees and the horizontal component of the motion of the jets is substantially parallel to the recirculation path of the main body of water at the point of impact. The jets are divided regularly over the water surface of the vessel. (Sinha-OEIS)
W81-01732

HIGH-EFFICIENT ACTIVATED SLUDGE METHOD,
Hitachi, Ltd. (Japan). (Assignee).
N. Shimizu, and Y. Odawara.
U.S. Patent No 4,202,763, 9 p, 5 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 624, May 13, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Biological treatment, Aeration, Activated sludge, Oxygen.

Waste water containing organic materials is introduced into an aeration tank, and is subjected to aeration treatment in the presence of activated sludge, while supplying oxygen to the aeration tank. The organic materials contained in the waste water are oxidized by high-efficient activated sludge at a high oxygen transfer rate. (Sinha-OEIS)
W81-01733

PROCESS FOR REMOVING OIL PARTICLES FROM WASTE WATER CONTAINING THE SAME,
H. Ono, T. Saida, and K. Fukumura.
U.S. Patent No 4,202,766, 5 p, 5 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 624-625, May 13, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Oil wastes, Adsorption, Coagulation, Calcium hydroxide, Filtration.

The process of the invention comprises introducing into the waste water at least one compound selected from the group consisting of hydroxides and oxides of calcium for absorbing and/or coagulating the oil particles; introducing an acid into the waste water for dissolving the compound to permit the oil particles to be freed and/or converted into larger-size oil particles; and finally, separating the liberated oil from the waste water. The oil thus liberated is easily separated by permitting it to rise to the surface of the waste water by specific gravity difference. Upon separation, the oil particles having larger sizes can be removed almost directly. Smaller particles are removed by a filter having oleophilic synthetic resin fibers. (Sinha-OEIS)
W81-01734

PROCESS AND DEVICE FOR THE PURIFICATION OF WASTE WATER BY MEANS OF ELECTROFLOTATION,
Stamicarbon, B.V., Geleen (Netherlands). (Assignee).
M. Alfenaar.
U.S. Patent No 4,202,767, 4 p, 2 Tab, 2 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 625, May 13, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Electrodes, Foam separtion, Suspended solids, Equipment, *Electroflotation.

A process for separating emulsified or suspended substances from waste water by electroflotation comprises passing that waste water through electrodes consisting of perforated material to produce a foam of gas and entrapped particles which were suspended or emulsified in the waste water and removing the foam. The diameter of the apertures of the material of the lower electrode is at most 5 millimeters and at least as large as is necessary to ensure proper passage of the liquid without hindrance to the upward movement of the gas bubbles through the liquid. (Sinha-OEIS)
W81-01735

APPARATUS FOR PURIFICATION OF WASTE WATER BY MEANS OF ACTIVE CARBON,
Berghau-Forschung G.m.b.H., Essen (Germany, F.R.). (Assignee).
G. Gappa, H. Juntgen, and J. Klein.
U.S. Patent No 4,202,770, 7 p, 2 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 626, May 13, 1980.

Descriptors: *Patents, *Waste water treatment, *Water purification, Separation techniques, Activated carbon, Organic wastes, Adsorption, Flow control, Equipment.

An apparatus for purification of waste water includes an upright adsorber filled with active carbon passing in downward direction through the adsorber while waste water flows in an upward direction. A distributing arrangement at the region of the lower end of the adsorber, into which waste water is fed, is provided to assure a substantial even distribution of the waste water during its upward flow through the carbon column. Furthermore, a regulating arrangement is provided to regulate the flow of the carbon through the adsorber in dependence on the concentration of the organic contaminants adsorbed by the carbon. (Sinha-OEIS)
W81-01737

SUPERVISION AND CONTROL SYSTEM AT THE KANAGAWA WASTE WATER TREATMENT PLANT, YOKOHAMA,
Sewage Works Bureau, Yokohama (Japan).
Y. Hattori.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 931-937, May, 1980. 3 Fig, 2 Tab.

Descriptors: *Waste water treatment, *Automatic control, *Treatment facilities, *Computers, Data processing, Automation, Equipment, Quality control, Management, Personnel, Japan, *Yokohama(Japan).

The supervision and process control system at the Kanagawa waste water treatment plant (Yokohama, Japan) is a tier-distributed processing system equipped with a computer. The system was designed to enhance automation of the plant, reduce labor costs, provide a wide range of supervision, and improve quality control by the sensors, including the qualitative measuring instruments. The operation and control of the plant including two pumping relay stations are supervised and controlled by two operators during the night and on holidays. The centralized supervision system provides process values and the status of many different operations, as well as controlling local processes and the relay pumping stations. The quantitative and qualitative measurement and control system has duplicate instrumentation and mutual backups for vital measurements. Qualitative and quanitative measurements are displayed on the CRT and recorded on recording meters and automatically fed to a series of programs to produce daily and monthly reports. The system also does everything necessary for the plant to obtain stable operation; the choice of treatment mode can be changed to meet influent needs. The system is still under development. (Small-FRC)
W81-01765

KINETICS OF PHENOL DEGRADATION BY ACTIVATED SLUDGE IN A CONTINUOUS-STIRRED REACTOR,
Milan Univ. (Italy). Inst. of Physical Chemistry.
P. Beltrame, P. L. Beltrame, P. Carniti, and D. Pitea.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 126-133, January, 1980. 6 Fig, 3 Tab, 11 Ref.

Descriptors: *Activated sludge, *Phenols, Industrial wastes, Domestic wastes, *Waste water treatment, Mathematical studies, Water pollution treatment, Equations, Biodegradation, Biological treatment.

Three activated sludges, labeled A, B, and C, obtained from the industrial and domestic waste water treatment plant at Parabiago, Italy, were adapted to phenol as the sole carbon source. Kinetics of phenol degradation in a continuous stirred reactor were monitored by the 4-amino-antipyrine method. Kinetic runs were performed at 20 degrees C with sludges A, B, and C with a hydraulic retention time of 1.56 hours and with sludge C with a hydraulic retention time of 6.25 hours. Results showed that phenol was degraded by an adapted activated sludge with kinetics resembling those reported for other cases of mixed culture aerobic waste treatment. In the concentration range tested (up to 360 milligrams/liter in the influent), no substrate inhibition was evidenced, although the large saturation constant (245 milligrams/liter) suggested a greater difficulty in achieving low phenol levels than with other wastes. The rate of phenol removal by a sludge was affected to some extent by the type of sample initially used for preparing the adapted sludge. Influent phenol concentrations had a marked effect on the rate of phenol removal by a sludge. (Geiger-FRC)
W81-01786

CONTROL OF AEROBIC DIGESTION BY SUBSTRATE CONCENTRATION,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
M. F. Hamoda, and J. Ganczarczyk.
Canadian Journal of Civil Engineering, Vol 7, No 3, p 456-465, September, 1980. 8 Fig, 4 Tab, 17 Ref.

Descriptors: *Activated sludge, *Aerobic treatment, *Suspended solids, Performance, Nitrification, Sludge digestion, Laboratory tests, Waste treatment.

Laboratory studies on aerobic digestion of activated sludge showed that an initial concentration of solids might be effective in reducing digester volume required for sludge stabilization and in lowering the associated rates of nitrification. The use of activated sludges of higher solids concentration in aerobic digesters may be a means of reducing the required digester volume. In the studied range of concentrations (to 3.5%), significant reductions of volatile suspended solids could be achieved with 10 to 15 days detention time at 20C, and a stable product sludge was obtained. Higher solids concentrations were associated with lower rates of nitrification. Thus, sludge solids concentration could be used to control nitrogen transformation during aerobic digestion of organic sludges. This could reduce sludge stabilization oxygen requirements. There are similar trends in batch digestion and semicontinuous digestion systems, but the method is not totally applicable to the design of continuous flow aerobic digesters. (Small-FRC)
W81-01787

COMPARISON OF CHLORINE DIOXIDE AND CHLORINE IN WASTE WATER DISINFECTION,
Stanford Univ., CA. Dept. of Civil Engineering.
E. M. Aieta, J. D. Berg, P. V. Roberts, and R. C. Cooper.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 810-822, April, 1980. 10 Fig, 7 Tab, 16 Ref.

Descriptors: *Chlorine, *Water purification, *Disinfection, Viricides, Water pollution control, Performance, *Waste water treatment, Bacteria, Ef-

fluents, Chlorine dioxide, Residuals, Coliforms, California, *Palo Alto(CA).

Chlorine and chlorine dioxide gave essentially equivalent coliform survival ratios when waste water treatment effectiveness was compared. Secondary effluent from a conventional activated-sludge process at Palo Alto Water Pollution Control Plant was used in the evaluations. The disinfectants were compared on a mass dose basis at a 30-minute contact time in non-nitrified secondary effluent. Chlorine dioxide was a more rapid agent, effecting greater bacterial inactivation than combined chlorine at the shorter contact times. On a residual basis, chlorine dioxide achieves the same survival ratio as chlorine, but with a lower residual concentration when chlorine exists as chloramines. The dose required to maintain a given residual in waste water is greater for chlorine dioxide. Chlorine dioxide was a more effective viricide than combined chlorine when investigated by measuring Poliovirus I survival in secondary effluent. (Small-FRC)
W81-01792

SOLIDS SEPARATION IN ACTIVATED SLUDGE SYSTEM DESIGN AND OPERATION,
A. W. Busch, and R. L. Irvine.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 804-809, April, 1980. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Suspended solids, *Activated sludge, *Design, *Sewage treatment, Filtration, Coagulation, Sedimentation, Technology, Performance, Standards, Water quality, Upgrading, Separation techniques.

The design and operation of five systems to reduce suspended solids in activated sludge systems are discussed. This improved treatment level will be necessary to reach the goal of fishable and swimmable public waters by 1983. Case I is the modification of an existing system at the secondary treatment level only. The secondary clarifier must be operated properly, or the biological reactor must utilize organisms that have good settling characteristics. Case II is the modification of an existing system by add-on filtration. Case III is the modification of an existing system at the secondary level plus add-on filtration. Case IV is the modification of an existing system by add-on coagulation, sedimentation, and filtration. These three systems all add some further treatment. Case V is a new system design which optimizes biological removal of soluble substrates and chemical removal of suspended solids. The Garrett scheme for hydraulic control of biomass growth rate is shown to be cost effective in overall system assessment. To meet higher effluent quality requirements, adding on more treatment stages is shown to be not cost effective and may not even accomplish the objective. Case V may be the best answer. (Small-FRC)
W81-01793

CARBON ADSORPTION ENHANCEMENT WITH OZONE,
Culp/Wesner/Culp, Cameron Park, CA.
R. L. Culp, and S. P. Hansen.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 270-281, February, 1980. 8 Fig, 1 Ref.

Descriptors: *Activated carbon, *Chemical oxygen demand, *Ozone, *Organic loading, Cost analysis, Adsorption, Organic compounds, *Waste water treatment, Effluents, South Tahoe(CA), California, Chlorination, Bacteria, Waste treatment, Cost estimates, Pilot plants, Filtration.

Adding ozone (3 or 10 mg per liter) during activated carbon treatment of secondary effluent did not sufficiently enhance COD removal in pilot plant studies at South Tahoe, California, to warrant installation of a full-scale plant. Tests were continued until COD breakthrough occurred. The best test results showed an 80% increase in adsorptive capacity, but these high results were not duplicated in subsequent runs. Several characteristics of the system in this facility contributed to the negative results--chlorine residuals and low soluble COD in the effluent and low biological activity and normally aerobic conditions on the adsorption bed. Ozone-enhanced activated carbon adsorption has been used successfully in Europe and in Cleveland, where different conditions prevail. It is believed that several factors affect the results of ozone addition--nature of the organic material, amount of organic loading, presence or absence of aerobic conditions, species and growth of bacteria, and pretreatment of effluent. (Cassar-FRC)
W81-01799

EFFECT OF PRECIPITATION AND EVAPOTRANSPIRATION OF A SEPTIC TANK-SAND FILTER DISPOSAL SYSTEM,
Ontario Ministry of the Environment, Toronto. Applied Sciences Section.
M. Brandes.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 59-75, January, 1980. 4 Fig, 8 Tab, 24 Ref.

Descriptors: *Septic tanks, *Precipitation(Atmospheric), *Evapotranspiration, Domestic wastes, Coliforms, Sands, Filters, Flow, Nitrogen, Phosphorus, *Waste water treatment, Performance, Soil disposal fields.

A field study investigated the year-long operation of a newly constructed large underdrained sand filter and determined the effect of atmospheric precipitation and evapotranspiration on the removal of chemical and bacterial contaminants by the sand filter medium. The waste water treatment system consisted of a two-compartment septic tank and a sand filter equipped with measuring devices for monitoring waste water flow and periodically collecting samples. The average precipitation rate for the year was 2.47 mm/d, and the average evapotranspiration rate was 1.44 mm/d, or 58.3% of the precipitation. During the snow melt season, the outflow from the sand filter was about twice as high as the inflow; and during the summer months, the evapotranspiration rate exceeded the precipitation rate by 8.8%. The retention of phosphorus by the filter medium was 42.6%, and the removal of total nitrogen was 40.4%. The removal of total and fecal coliforms was almost 100%. Soil filters should be designed to enable a maximum possible runoff to reduce the infiltration of water from atmospheric precipitation. Higher sun exposure and evapotranspiration are advantages of soil filter operation. (Small-FRC)
W81-01800

EFFECTS OF COAL SLURRY ON WASTE WATER BACTERIA AND BACTERIOPHAGE,
Science Applications Inc., Los Angeles, CA.
L. W. Margler, and M. B. Rogozen.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 53-58, January, 1980. 1 Fig, 3 Tab, 20 Ref.

Descriptors: *Coals, *Adsorption, *Bacteria, Waste water treatment, Laboratory tests, Bacteriophage, Coliforms, Slurries, Pipelines.

The possibility that waste water exposure to coal in a slurry pipeline would upgrade the microbiological quality of the waste water effluent was examined. Bacterial adsorption onto coal might be possible, and then the bacterial population would be removed from the water along with the coal at the end of the pipeline. Bacteria adsorbed onto finer coal particles that pass through centrifuges or filters would be removed during clarification of recovered slurry water. Also, coal contains numerous organic compounds and heavy metals that can be toxic to bacteria. Laboratory experiments indicated that coal slurry was only mildly toxic to coliform bacteria; there was a 70% reduction in coliforms, and the fecal streptococcal concentration remained virtually unchanged. However, 99.8% of the E. coli C-specific phage present in the waste water became noninfective in the coal slurry; thus, exposure to coal slurry may upgrade the waste water. Further study is needed to determine the effect of slurry on pathogenic enteric viruses. (Small-FRC)
W81-01801

INDICATOR BACTERIA AND SALMONELLA IN FOOD-PROCESSING AND DOMESTIC EFFLUENT,
Elainlaaketieteellinen Korkeakoulu, Helsinki (Finland).
J. Hirn.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 48-52, January, 1980. 1 Fig, 3 Tab, 21 Ref.

Descriptors: *Coliforms, *Salmonella, *Food processing industry, Municipal wastes, Public health, Performance, *Waste water treatment, Biological treatment, Poultry, Finland.

The composition and reduction of the fecal indicator bacteria and Salmonella flora was studied in a treatment system that received its principal effluent from a food processing plant using broiler chickens and also received waste water from a rural community. Effluent and waste water samples were collected at the Saarioinen-Sahalahti treatment plant, located 200 km north of Helsinki (Finland). The plant has a high rate biological filter and serves the Saarioinen food processing plant (broiler chickens) and the rural Sahalahti community. The number of fecal coliforms was higher in the waste water, while the numbers of fecal streptococci in the two waters were almost equal. Biological and chemical purification reduced fecal coliforms and fecal streptococci by over 99%. Salmonella were found in the waste water and plant effluent. Salmonella infantis was detected in the effluent when infected flocks of chickens entered the plant. The continuous bacteriological control of the effluent from this type of food plant by analyses of the fecal indicators and Salmonella is of great public health importance. (Small-FRC)
W81-01802

A METHOD FOR THE CALCULATION OF BIOLOGICAL FILM VOLUME IN A FLUIDIZED BED BIOLOGICAL REACTOR,
McMaster Univ., Hamilton (Ontario).
M. Tsezos, and A. Benedek.
Water Research, Vol 14, No 6, p 689-693, June, 1980. 2 Fig, 3 Tab, 5 Ref.

Descriptors: *Biological treatment, *Mathematical models, Films, Fluidized bed reactor, Columns, Particle size, Particle shape, Aerobic, Activated carbon, *Waste water treatment, Bacteria.

This paper derives the theoretical relationships governing bed height and biofilm volume in a fluidized bed and attempts to determine the validity of these relationships through a comparison of calculated and experimentally determined particle diameters. The fluidized bed bioreactor was constructed from 10.2 cm i.d. plexiglass, and the medium chosen for study was granular activated carbon. Sources of error that might affect the validity of the calculations were inlet flow distribution problems, inaccuracies of direct particle diameter measurement methods, and inaccuracies in assumed biofilm density values. The authors concluded that (1) the expanded bed height in a fluidized bioreactor can be theoretically connected to biofilm volume in the reactor, (2) the proposed correlation can be used to calculate the biofilm volumetric yield, and (3) some of the error associated with particles without biofilm can be eliminated through the use of shape factors. (McKeon-FRC)
W81-01805

CALORIMETRIC STUDIES OF BIODEGRADATION PROCESSES IN BIOLOGICAL WASTE WATER TREATMENT,
Sherbrooke Univ. (Quebec).
J-L. Fortier, B. Reboul, P. Philip, M-A. Simard, and P. Picker.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 89-97, January, 1980. 7 Fig, 2 Tab, 11 Ref.

Descriptors: *Microcalorimetry, *Biodegradation, Analytical techniques, Monitoring, *Waste water treatment, Biological treatment, Biochemical oxygen demand, Chemical oxygen demand, Oxy-

genation, Cultures, Toxins, Kinetics, Sludge bacteria, Pilot plants.

Preliminary studies were carried out to test the use of a fast-response flow microcalorimeter for monitoring biodegradation processes in a waste water treatment plant. Calorimetric results were correlated with those from biochemical oxygen demand (BOD) and chemical oxygen demand (COD) studies. Calorimetric experiments consisted of those in which the effluent and culture were mixed inside the calorimetric cell and those in which mixing was performed outside. Adequate microwatt sensitivity for monitoring heat evolved during biodegradation was achieved. A heat output on the order of 24-500 microwatts could be determined from mixing a culture containing about 0.1% suspended solids with a biodegradable effluent (0.1% COD). Where the culture-effluent mixing could be carried out within the calorimetric flow cell, the time constant for the measurement was about 1 minute. When the mixing was done prior to injection in the flow cell, the overall time of the measurement increased to 2 minutes. In either method, important kinetic data may be obtained by monitoring the initial response of the culture to COD shock loads or inhibitors. Changes in heat flux determined by the present method were qualitatively correlated with results obtained from respirometric procedures, and the heat output is closely associated with the rates of the biodegradation reaction. (Geiger-FRC)
W81-01806

EFFECTS OF WATER CONSERVATION ON SANITARY SEWERS AND WASTE WATER TREATMENT PLANTS,
Los Angeles County Sanitation Districts, CA.
J. T. DeZellar, and W. J. Maier.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 76-88, January, 1980. 7 Fig, 10 Tab, 11 Ref.

Descriptors: *Water conservation, *Waste water treatment, Water utilization, Sewerage, Water quality, Flow rates, Suspended solids, Biochemical oxygen demand, Environmental effects, Nitrogen, Sulfur Phosphates, Effluents, Costs.

The effects of reduced water usage due to conservation measures on waste water collection and treatment systems were examined in relation to waste water composition, performance of collection and treatment facilities, and quality characteristics of treated effluent water. Conventional design correlations were used to describe sewer performance characteristics, while treatment system performance was evaluated using a published computer program. Results were compared with field data recorded from several California waste water treatment plants during conditions of drought from 1975 to 1977. Conservation measures caused reduced flows, resulting in sediment accumulations in sewer lines and methane and hydrogen sulfide corrosion of pipes due to anaerobic decomposition. Generally, biochemical oxygen demand (BOD) and total suspended solids increased, while the effects of reduced water use on nitrogen, sulfur and phosphate levels were inconclusive. Increased detention times in all unit processes were also noted with lower flows. Septic conditions often occurred in primary sedimentation tanks. Although concentrations of most parameters were increased in the final effluent, effluent loads were usually decreased, resulting in reduced environmental impacts. Specific suggestions for future plant designs to meet the challenges imposed by water conservation measures are offered. (Geiger-FRC)
W81-01807

NUTRIENT REMOVAL IN SUSPENDED GROWTH SYSTEMS WITHOUT CHEMICAL ADDITION,
Dorr-Oliver Inc., Stamford, CT.
P. M. Sutton, B. E. Jank, and D. Vachon.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 98-109, January, 1980. 11 Fig, 3 Tab, 22 Ref.

Descriptors: *Pilot plants, *Nutrient removal, Sludge, Nitrification, Denitrification, Sludge bacteria, *Waste water treatment, Biological treatment, Phosphorus, Nitrogen, Chemical oxygen demand, Organic compounds, Aerobic conditions, Anaerobic conditions.

A pilot plant study was conducted at the Waste Water Technology Center, Ontario, to obtain quantitative data on effects of various factors on P removal in single sludge systems and to determine the effects of anoxic and anaerobic conditions on the growth rates of the nitrifiers. Data was also acquired on N removal in single-sludge systems where denitrification relied on the organics present in the waste water and/or an external carbon source. Over a period of 4 months, three parallel single-sludge systems (A, B, and C) were operated according to a predetermined experimental design. Systems A and C were designed to achieve nitrification, partial denitrification, and enhanced P uptake. System B was designed to achieve only nitrification and served as a control. Systems D and E were designed to study N removal and give additional information on P removal. Results of the pilot plant operations showed that anaerobic conditions of up to 4 hours had no observable detrimental effect on nitrification. High levels of P removal were achieved in single sludge systems without chemical additions. The quantity of P removed was dependent on the level of COD removed in the system. Exposing the biological population to alternating anaerobic-aerobic conditions did not enhance P uptake into the sludge. A high level of N removal was obtained in single sludge systems without the addition of an external carbon source. (Geiger-FRC)
W81-01808

FACULTATIVE WASTE STABILIZATION POND DESIGN,
Humboldt State Univ., Arcata, CA.
B. A. Finney, and E. J. Middlebrooks.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 134-147, January, 1980. 10 Fig, 13 Tab, 14 Ref.

Descriptors: *Model studies, *Design criteria, *Oxidation lagoons, Kinetics, *Waste water treatment, Federal government, State governments, Mathematical studies, Equations, Organic loading, Hydraulic design, Flow profiles, Stabilization.

Four intensive facultative lagoon performance studies sponsored by the EPA were carried out at Peterborough, New Hampshire; Kilmichael, Mississippi; Eudora, Kansas; and Corinne, Utah. Criteria for optimum stabilization pond design were evaluated using data collected from the four sites along with data on organic loading and hydraulic detention time, empirical design equations, and rational design equations. The three models proposed proved inadequate as designs for facultative waste stabilization ponds. Often federal discharge standards were violated while the pond satisfied state orgnic loading and hydraulic detention time design criteria. The predictions yielded by the three empirical design equations and the two kinetic design models were not substantiated by published pond performance data. While the two kinetic models differed in their basic assumptions on the hydraulic flow patterns, neither described the measured performance. It was recommended that future research on pond performance consider the effect of physical and climatic conditions on hydraulic residence time. (Geiger-FRC)
W81-01809

AN INVESTIGATION OF THE INITIAL DILUTION OF SEWAGE DISCHARGED THROUGH SUBMARINE DIFFUSERS,
Techniche Eliminazione Inquinamenti, Milan (Italy).
P-G. Vigliani, B. Sclavi, R. Olivotti, A. Visconti, and G-F. Tartaglia.
Progress in Water Technology, Vol 12, No 1, p 321-337, 1980. 12 Fig, 1 Tab.

Descriptors: *Waste dilution, *Outfall sewers, *Diffusion, Mathematical models, Sewage, Nozzles, Salinity, On-site investigations, Europe, Sewage effluents.

The behavior and dilution of the dispersion plume of a domestic sewage source were investigated under various conditions, and several mathematical models were evaluated. Dilution was determined by measuring the salinity and the concentration of silicates within the plume. These values, together with the physical properties (velocity, temperature, etc.) were compared with values obtained using mathematical models. The procedure was repeated under varying conditions, including different diameters and directions of the discharge nozzle. The Cederwall formula was found to be the most suitable for predicting a safe value of initial dilution of a horizontally discharged jet, while the Cooley and Harris formula were simple and fairly accurate. The Rawn, Bowerman, and Brooks diagram gave unacceptably high results. The Fischer and Brooks diagram was useful for predicting the plume profile when the jets were in parallel. (Small-FRC)
W81-01810

SYNTHESIS OF WASTE TREATMENT SYSTEMS BY IMPLICIT ENUMERATION,
Environmental Protection Agency, Cincinnati, OH.
L. A. Rossman.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 148-160, January, 1980. 2 Fig, 10 Tab, 21 Ref.

Descriptors: *Computer models, *Designs, *Waste treatment, Model studies, Equations, Mathematical studies, Waste water treatment, Sludge treatment, Kinetics, Cost analysis, Structural analysis, Operations research, Simulation analysis.

The synthesis of waste water treatment systems involves specifying both the unit processes and operations as well as the design of the individual units within the structure. Ideally, models should integrate the designs of waste water and sludge treatment subsystems, select structure and design from a finite number of discrete alternatives, handle multiple pollutants or waste stream parameters, use principles of mass balance and reaction kinetics in predicting performance, evaluate costs and other systems criteria, and use a computationally efficient solution method. A new computer aided design procedure for waste treatment developed by the EPA is described. The method uses an implicit enumeration approach to select the combination of units that will best meet a set of design criteria from a list of unit process alternatives with fixed design specifications. The effect of return sidestream flows from sludge treatment units is approached by assigning representative penalty values to stream components which may be updated as new system designs are generated. Cost/energy-effectiveness analyses may be accomplished for design problems with over 15,000 alternate system configurations. The model presented is best applied in generating alternative system designs that emphasize different objectives to various degrees. (Geiger-FRC)
W81-01811

AUTOHEATED AEROBIC THERMOPHILIC DIGESTION WITH AERATION,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
W. J. Jewell, and R. M. Kabrick.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 512-523, March, 1980. 11 Fig, 2 Tab, 16 Ref.

Descriptors: *Aerobic treatment, *Aeration, *Heating, *Sludge treatment, Chemical oxygen demand, Biodegradation, Organic matter, Performance, Temperature, Equations.

A two-year project planned to demonstrate that a simple autoheated aerobic digestion process using full-scale equipment could be used to treat waste water sludge is presented. Mixtures of thickened waste, activated sludge and primary sludge were autoheated to temperatures in excess of 43C under all conditions for over a year. Self-aspirating aerators and well-insulated tanks in a full-scale reactor volume of 28.4 cu m were used; these had previ-

ously proven successful in treating animal wastes. Slurry temperatures exceeded 50C and reached a maximum of 63C. The reactors were easily started, and achieved temperatures in excess of 40C in about 10 days, even in cold weather. Maximum organic removal rates were obtained at loading rates between 8 and 10 kg of biodegradable COD/cu m - day. The equipment conserved heat of oxidation. An equation is given for calculating the potential for autoheating. The increase in temperature in degree C in the aerated slurry equals 2.4 times the COD in g/liter oxidized at hydraulic retention times less than 8 days. (Small-FRC)
W81-01812

DESIGN OF AN OVERLAND FLOW SYSTEM,
Brown and Caldwell, Walnut Creek, CA.
D. L. Tucker, and N. D. Vivado.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 559-567, March, 1980. 3 Fig, 1 Tab, 11 Ref.

Descriptors: *Septic tanks, *Overland flow, *Oxidation lagoons, Food processing industry, Industrial wastes, Agricultural watersheds, Biodegradation, Algae, *Waste water treatment, Design, Treatment facilities.

A design to upgrade the Newman Waste Water Treatment plant (California) is reviewed, with emphasis on the overland flow terrace system which is planned to remove algae from the oxidation pond effluent. Newman is an agricultural center with two milk processing and three vegetable packing plants. The facility includes septic tanks, followed by biological treatment in oxidation ponds. Increased industrial loadings in 1975 overloaded the system and caused several fish kills in the San Joaquin River. In the new system, septic tank effluent which currently flows in a ditch will be piped to an oxidation pond recirculation channel, where it will be mixed with recirculated pond water before being distributed to an aeration pond. Water will flow from the 5-acre aeration pond to the 50-acre oxidation pond. Oxidation pond effluent will flow through an effluent structure containing a chlorination injection and sampling facility, and then through a 30-minute contact chlorine chamber. Effluent will then be pumped to the overland terraces. (Small-FRC)
W81-01815

TOTAL NITROGEN REMOVAL IN A MULTI-CHANNEL OXIDATION SYSTEM,
Rexnord Inc., Milwaukee, WI.
C. S. Applegate, B. Wilder, and J. R. DeShaw.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 568-577, March, 1980. 4 Fig, 8 Tab, 14 Ref.

Descriptors: *Nitrogen, *Activated sludge, *Oxidation lagoons, Aeration, *Nitrogen removal, Oxygenation, *Waste water treatment, Nitrification, Ammonia, Organic matter, Treatment facilities, Performance.

An oxidation ditch/activated sludge plant was investigated to obtain baseline information on normal plant performance. Total nitrogen removal, up to 91%, was demonstrated by an endogenous nitrate respiration system. Very stable organic and nitrogen removals were obtained with no special operator attention. Plant effectiveness was due to several plant features, including multiple aeration channels in series. These allowed oxygen concentration control in each channel, permitting favorable conditions for the removal of carbonaceous material, ammonia oxidation, and nitrate reduction. Nitrogen removal was enhanced by splitting the feed to the first two aeration channels. Rotating disk aerators provided adequate channel mixing. Oxygen input was easily controlled by changing the number of disks or controlling disk submergence. Complete nitrogen removal allowed partial recovery of alkalinity and oxygen used for nitrification. Also, sludge flotation in the final clarifier was avoided. (Small-FRC)
W81-01816

REMOVAL OF ORGANIC SUBSTANCES BY BIOLOGICALLY ACTIVATED CARBON IN A FLUIDIZED-BED REACTOR,
McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
M. Tsezos, and A. Benedek.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 578-586, March, 1980. 10 Fig, 4 Tab, 11 Ref.

Descriptors: *Adsorption, *Activated carbon, *Organic compounds, Performance, Sludge treatment, Waste treatment, Dissolved oxygen, Fluidized-bed reactor, *Waste water treatment.

Adsorbents which show promise for removing nondegradable organic substances generated during the treatment process were investigated. Batch adsorption isotherm tests on a bioresidual solution were used to evaluate F-1 activated alumina, XAD-4, XAD-7, XAD-8, Filtrasorb 400 activated carbon, Special A activated carbon, WRL 200 A anionic resin, and IRA 458 anionic resin. Continuous runs were performed in the fluidized-bed reactor system. All of the adsorbents except Filtrasorb 400 adsorbed only a fraction of the residual organics and indicated very low adsorptive capacities. Filtrasorb 400 adsorbed all of the biologically generated residual organics, and its maximum adsorptive power was more than 20 times higher than that of the other adsorbents tested. The volumetric yield of biofilm in an aerobic fluidized bed falls in the range of 0.8 to 2.9 cu cm/g total organic carbon oxidized. Inlet dissolved oxygen concentration had a strong positive effect on this yield. The level of inlet dissolved oxygen just sufficient for preventing anaerobiosis is recommended as a design optimum for fluidized bed bioreactors. (Small-FRC)
W81-01817

SCALEUP IN ROTATING BIOLOGICAL CONTACTOR DESIGN,
International Environmental Consultants Ltd., Toronto (Ontario).
R. W. Wilson, K. L. Murphy, and J. P. Stephenson.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 610-621, March, 1980. 8 Fig, 2 Tab, 19 Ref.

Descriptors: *Pilot plants, *Treatment facilities, *Design standards, *Waste water treatment, Biochemical oxygen demand, Nitrification, Temperature, Flow, Performance, Rotating biological contactors, Upgrading, Municipal wastes.

A scaleup plan and general design guidelines are presented for a rotating biological contactor (RBC) for treating municipal waste water. A pilot plant facility consisted of a coarse screen, grit tank, two primary clarifiers, three rotating biological contactors, and one secondary clarifier. During the scaleup evaluation, a 0.5 m unit was operated in parallel with the 2.0 m unit. Organic carbon removal rate decreased with increasing disk diameters at a given loading and media tip speed. There was little difference in the ability of the two RBC's to nitrify the waste water. For BOD removal, a surface area scaleup factor of 25% should be applied when designing a full-scale RBC system using 0.5 m RBC data. No scaleup factor is required for combined BOD removal plus nitrification. As part of a generalized design procedure, sample loadings that were derived from test data from the 2.0 m pilot RBC are presented in a table. Factors considered in developing these loadings were: scaleup factor, temperature effects, and natural diel variations in waste water flow and strength. (Small-FRC)
W81-01820

CURRENT STATUS OF WATER RECLAMATION AT WINDHOEK,
National Inst. for Water Research, Pretoria (South Africa).
L. R. J. van Vuuren, A. J. Clayton, and D. C. van der Post.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 661-671, April, 1980. 8 Fig, 8 Tab, 2 Ref.

Descriptors: *Water reuse, *Effluents, *Costs, Lime, Ammonia, Activated carbon, Adsorption, *Treatment facilities, Potable water, Chlorination, South Africa, *Windhoek(South Africa).

The Windhoek water reclamation plant (WRP I) was designed for the reclamation of water from maturation ponds that serve as polishing stages for secondary effluent discharged by upstream conventional waste treatment facilities. The plant was originally opened in 1963; by 1973 modifications were needed to continue water reclamation. The plant was modified to include high-lime treatment, ammonia stripping, improved activated carbon adsorption capacity, and carbon regeneration. The utilization duration of the facility improved to 10 months/year. After modification, the chemical, biochemical, and microbiological quality was highly satisfactory. The cost of reclaimed water was approximately $0.32/cu m as compared with $0.21/cu m for other sources in the area. The cost was dependent on chlorination demand, with associated ammonia concentration in the feed water. Currently, additions to the facility are planned which will provide for biological denitrification and phosphate removal. (Small-FRC)
W81-01822

ON-SITE WASTE WATER TREATMENT ON PROBLEM SOILS,
Minnesota Pollution Control Agency, Roseville.
M. J. Hansel, and R. E. Machmeier.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 548-558, March, 1980. 7 Fig, 1 Tab, 34 Ref.

Descriptors: Regulation, *Septic tanks, *Domestic wastes, Percolation, Permeability, Soil water movement, Design, Treatment facilities, Trenches, *Soil types, Performance, Minnesota, *Waste water treatment, Soil properties.

The development of standards for on-site systems for both suitable and problem soils are discussed, and specific design criteria are presented for four problem soil conditions. The Minnesota Pollution Control Agency began developing standards for the design, location, construction, and maintenance of on-site systems in 1974. By 1977, when the standards went to formal public hearings, over 1000 residents knew the technical details of the standards. It is necessary to have 0.9 m of unsaturated soil for proper treatment of waste water. Drain-field trenches are effective for normal soil treatment systems. Problem soils require different approaches. Rapidly permeable soils may require a trench lined with less permeable soil to aid in the formation of a biological mat. Slowly permeable soils require a mound system, and the sides of the trench must be raked or scarified. For high groundwater table or bedrock, there are many systems that can be installed a little higher than usual, which will give satisfactory results. Also, the groundwater can be lowered artificially. The mound system, which locates treatment above the original ground in elevated fill, is the solution to many problem locations. (Small-FRC)
W81-01824

POWDERED VERSUS GRANULAR CARBON FOR OIL REFINERY WASTE WATER TREATMENT,
Amoco Oil Co., Naperville, IL.
C. G. Grieves, L. W. Crame, D. G. Venardos, and W-C. Ying.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 483-497, March, 1980. 14 Fig, 9 Tab, 15 Ref.

Descriptors: *Activated sludge, *Oil wastes, *Activated carbon, Performance, Particle size, Costs, *Waste water treatment, Industrial wastes.

Powdered activated carbon (PAC) addition to activated sludge for the treatment of oil refinery waste water was evaluated at Amoco's Texas City, Texas, plant; at the Wood River Refinery; and in bench tests. Variables investigated were: degree of pretreatment, sludge age, PAC characteristics, PAC dose, and level of PAC in activated sludge

mixed liquor. PAC-enhanced sludge systems were successfully operated for extended periods at very high sludge ages (100 days) when optimum pretreatment was used. Systems can produce effluents with quality comparable to that of tertiary treatment by granular carbon adsorption. The PAC system was generally more cost effective than granular carbon systems. If high-surface-area carbon were available commercially, cost effectiveness would be even higher. Several questions remained to be answered about the process. For example, effluent variability and removal of nonconventional and priority pollutants from waste waters are topics which must be investigated. (Small-FRC)
W81-01825

WASTE WATER TREATMENT WORKS IN JAPAN: STATUS AND OUTLOOK,
Ministry of Construction, Tokyo (Japan). Sewage Works Div.
T. Tamaki.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 862-872, May, 1980. 3 Fig, 2 Tab.

Descriptors: *Sewerage, *Legislation, *Comprehensive planning, Treatment facilities, Construction, Standards, Water quality, *Japan, *Waste water treatment.

The history of sewerage in Japan, the current situation in waste water treatment, and the future are discussed. Waste water treatment was not a problem in Japan until recently because of widespread agricultural disposal and swift running rivers which emptied into the sea. Waste water treatment plants were required to comply with water quality standards with the passing of the Water Pollution Control Law in 1970. The most recent Sewerage Law required comprehensive basin-wide planning of sewerage systems, required the public to convert to sewerage within three years when it was available, and required effluent from factories and treatment plants to meet government standards. Five year sewerage construction plans are reviewed. Japan is studying control and treatment methods used in other countries and selecting and implementing those best suited for Japan's situation. (Small-FRC)
W81-01826

ANAEROBIC TOXICITY EVALUATION BY BATCH AND SEMI-CONTINUOUS ASSAYS,
Stanford Univ., CA. Dept. of Civil Engineering.
D. C. Stuckey, W. F. Owen, P. L. McCarty, and G. F. Parkin.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 720-729, April, 1980. 7 Fig, 4 Tab, 10 Ref.

Descriptors: *Anaerobic digestion, *Toxins, *Bioassay, *Chlorides, *Sludge, Toxicity, Vinyl chloride, Methylene chloride, Ethylene dichloride, Vinyl acetate.

Both batch and semi-continuous feed bioassays were evaluated as methods to determine the toxic effects of four organic materials on anaerobic digestion. Biological assay procedures offer promise in determining the causes of digester failure. Semi-continuous bioassays were conducted using continuously stirred 1.5 liter digesters operated at a 15-day detention time and a temperature of 35 degrees C. Batch bioassays were conducted using flasks or bottles containing 30 ml of a nutrient and buffer solution, 20 ml of sludge from a laboratory digester, and 0.100 ml of ethanol to serve as a substrate. The toxic effects of methylene chloride (MC), vinyl chloride (VC), ethylene dichloride (EDC), and vinyl acetate (VA) were studied. Using batch assay, the toxicity thresholds were: less than 3.16 mg/liter for MC, between 200 and 400 mg/liter for VA, about 2.5 mg/liter for EDC, and between 5 and 10 mg/liter for VC. Using semi-continuous assay, the toxicity thresholds were: 1.8 mg/liter for MC, 1200 mg/liter for VA, 5-7 mg/liter for EDC, and more than 64 mg/liter for VC. Batch systems measured the toxicity threshold of a slug dose and thus usually gave a conservative figure. Advantages of this method were low cost, speed, and high reproducibility. Semi-continuous assays cost more, take more time, and are less reproducible, but give a better indication of inhibitory effects. (Small-FRC)
W81-01827

COST OF WATER RECLAMATION BY ADVANCED WASTE WATER TREATMENT,
Orange County Water District, Fountain Valley, CA.
D. G. Argo.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 750-759, April, 1980. 3 Fig, 11 Tab.

Descriptors: *Costs, *Water reuse, *Treatment facilities, Capital costs, *Waste water treatment, Reclaimed water, Water conservation, California, Operating costs, Maintenance costs, *Orange County Water District(CA).

Cost data are presented for the Orange County Water District's Water Factory 21, a facility which can act as a model for water reuse projects. The advanced waste water treatment processes used at Water Factory 21 include lime clarification with sludge recalcination, ammonia stripping, recarbonation, breakpoint chlorination, mixed-media filtration, activated carbon adsorption with carbon regeneration, reverse osmosis demineralization, and postchlorination. The capital cost is $60/1000 cu m, and the operation and maintenance cost is $84/1000 cu m. The capital cost of reverse osmosis is $45/1000 cu m, and the operation and maintenance cost is $118/1000 cu m. Thus, the total cost of the blended water produced by Water Factory 21 is $90/1000 cu m capital and $131/1000 cu m operation and maintenance. Research is being conducted currently to reduce these costs. At current prices, reclaimed water is cheaper than imported water in Southern California. (Small-FRC)
W81-01829

EFFECTS OF WATER CONSERVATION ON MUNICIPAL WASTE WATER TREATMENT FACILITIES,
Association of Bay Area Governments, Berkeley, CA.
J. A. Davis, and T. A. Bursztynsky.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 730-739, April, 1980. 2 Fig, 3 Tab, 5 Ref.

Descriptors: *Treatment facilities, *Water conservation, *Municipal wastes, Low flow, California, *Waste water treatment, Evaluation.

The extent of flow reduction to be expected after implementation of water conservation practices in the San Francisco Bay Area and the effects of the reduction on waste water treatment facilities were examined. While the volume of waste water will be reduced by low-flush toilets, low-flow shower heads, hot water pipe insulation, etc., the volume of pollutants in the waste water will not be reduced. Problems which may result from reduced flow are excess organic deposition in grit chambers, determination of new chemical doses required, and reduced hydraulic head-loss. Trickling filters, sewers, sedimentation basins, and activated sludge systems will not be affected adversely. The 10 to 20% expected reduction in flow will probably result in some extension in the length of time before facilities become overloaded. New facilities should cost less if the water conservation continues. The performance of biological reactors may have to be improved, but overall effects of the conservation problem will be minor. (Small-FRC)
W81-01831

SEPTIC SYSTEM PROBLEMS ON AN URBAN FRINGE,
New Castle County Areawide Waste Treatment, Newark, DE.
D. R. Goehring, and F. R. Carr.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 89-102, March, 1980. 3 Fig, 3 Tab.

Descriptors: *Septic tanks, *Domestic wastes, *Urbanization, Sewers, Planning, Waste water treatment, Water quality control, Costs, Groundwater, Suburban areas, Utilities, Delaware, *New Castle County(DE).

Water quality and public policy problems associated with the use of septic systems in New Castle County (Delaware) are discussed, and solutions to some of these problems are reviewed. Septic systems are needed in areas where public sewers would be prohibitively expensive. Land use and public policy decisions can make the high costs of treating waste water even higher. Conventional cost-effectiveness logic can not be applied to existing waste water treatment alternatives without considering the costs of groundwater pollution in determining future land use and waste water treatment needs. The beneficiaries of septic system use must bear the responsibility of correcting the problem, not the general public. When the costs to homeowners of installing public sewers are high, septic tank usage is encouraged. When setting public policy on septic systems, total water quality management goals must be considered. (Small-FRC)
W81-01836

TOXIC INHIBITION OF ANAEROBIC BIODEGRATION,
California Univ., Berkeley. Sanitary Engineering Research Lab.
F. Pearson, C. Shiun-Chung, and M. Gautier.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 472-482, March, 1980. 7 Fig, 1 Tab, 10 Ref.

Descriptors: *Anaerobic treatment, *Recreation wastes, *Toxins, Inhibitors, Tourism, Zinc, Phenols, Retardants, Rates, Recreational vehicle wastes, Rest room rates.

Waste water discharged at highway comfort stations and RV dump stations was characterized, and the degree of anaerobic biodegradation inhibition by toxins in RV waste was evaluated. RV black water, RV gray water, mixed RV black water and gray water, and rest room wastes were analyzed and evaluated for content of four toxicants: formaldehyde, zinc sulfate, phenol, and quaternary ammonium-based proprietary product. The effects of time and toxicant concentration under shock loading on anaerobic gasification rate were determined in laboratory tests. Half-kill doses were established for shock loading (acclimation loading) as follows: formaldehyde - 200 mg/liter, zinc sulfate - 400 mg Zn/liter, phenol - 500 mg/liter, and quaternary ammonium compound - 50 mg organic N/liter. At the concentrations of formaldehyde, zinc sulfate, and quaternary ammonium compounds in RV wastes caused by preservative chemicals added for odor control, the rate of anaerobic degradation may be on the order of one-third to one-half that for toxicant-free anaerobic biodegradation. RV black water typically contained 15,000 mg COD/liter and 7500 mg suspended solids/liter, while gray water and rest room wastes were marginally stronger than domestic waste water. (Small-FRC)
W81-01845

AN ENZYMATIC PRETREATMENT TO ENHANCE THE LIME PRECIPITABILITY OF PULP MILL EFFLUENTS,
Institute of Paper Chemistry, Appleton, WI.
R. L. Schmidt, and T. W. Joyce.
Tappi, Vol 63, No 12, p 63-67, December, 1980. 2 Fig, 4 Tab, 12 Ref.

Descriptors: *Pulp wastes, *Waste water treatment, *Enzymes, Horseradish peroxidase, Chemical precipitation, Pulp and paper industries, Organic wastes, Wood wastes, Catalysts, Polymers, Effluents, Industrial wastes.

Laboratory studies revealed that pretreatment of pulp mill effluents with the enzyme, horseradish peroxidase, polymerized low molecular weight color bodies. Subsequent lime precipitation improved color removal by a factor of 50% relative to conventional lime treatment. Molecular weight distributions of color bodies in effluent treated with horseradish peroxidase and hydrogen perox-

ide contained 8% more high molecular weight material than in the treatment with peroxidase alone. A test using inactive horseradish peroxidase versus active peroxidase, both with hydrogen peroxide, showed that although inactive proteins did slightly improve precipitability of color bodies by lime, it was the enzyme effect which accounted for a 30-34% improvement relative to controls. An excess of hydrogen peroxide had a degrading effect on the color bodies, but it had in limited amounts a polymerizing effect. (Cassar-FRC)
W81-01848

BACTERIA CAN SOLVE MALODOURS AND GREASE PROBLEMS IN TREATMENT PLANTS.
Water and Pollution Control, Vol 118, No 12, p 17, December, 1980.

Descriptors: *Bacteria, *Sewage treatment, *Organic wastes, Operation and maintenance, *Grease, *Odor control, Ponds, Activated sludge, Citizens utility, Maintenance, Treatment facilities, Waste treatment, Treatment, Algae.

A company which handles treatment of waste water for several Illinois communities uses a dried bacteria formulation to control odors and grease, for example in an activated sludge polishing pond. Planned addition of these facultative anaerobes maintains dominance of introduced species over the indigenous bacteria. Undesirable side effects, all of which are easily handled, include foaming in tanks, algae bloom, and duckweed accumulation. Maintenance costs are reduced because pumps and sewer lines require less cleaning and repairs. During closedowns and phaseouts of treatment facilities, odors are prevented by adding about 60 pounds of bacteria formulation. (Cassar-FRC)
W81-01849

THE EFFECT OF ALUMINIUM AND FERRIC IONS ON THE ELECTROPHORETIC MOBILITY OF PARTICLES IN TREATED PIGGERY EFFLUENTS,
University Coll. of Swansea (Wales). Dept. of Chemical Engineering.
S. T. Thuraisingham, J. A. Howell, and D. J. A. Williams.
Water Research, Vol 14, No 9, p 1209-1213, September, 1980. 4 Fig, 25 Ref.

Descriptors: *Waste water treatment, *Farm wastes, *Coagulation, Aluminum, Iron compounds, Electrical properties, *Electrophoresis, Colloids, Separation techniques, Pig breeding, Aging(Biological).

Electrokinetic properties are reported for pig slurry particles in the clarified effluent following aerobic treatment. Hydrolyzable cations such as aluminum and ferric ions caused charge reversal of the negatively charged colloidal particles in freshly aerated pig effluent. This in turn changed the isoelectric point (IEP) of these particles. When pig effluent had been left standing for more than 15-20 days, no charge reversal occurred at ferric chloride concentrations less than 0.001 and at concentrations of aluminum sulfate between 0.01 and 0.0001 M. Colloidal particles coagulate best in the vicinity of their IEP. By adding hydrolyzed cation at the appropriate pH, charge neutralization can be achieved. Thus it is possible to coagulate pig slurry particles in freshly aerated effluent over a controlled pH with small amounts of electrolytes. Pig effluent should be freshly aerated immediately prior to chemical treatment to enable the coagulation to occur with low dosages of the coagulants. (Baker-FRC)
W81-01852

A QUANTITATIVE INVESTIGATION OF THE REACTION OF OZONE WITH P-TOLUENESULFONIC ACID IN AQUEOUS SOLUTION AS A MODEL COMPOUND FOR ANIONIC DETERGENTS,
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F. R.).
P. Joy, E. Gilbert, and S. H. Eberle.
Water Research, Vol 14, No 10, p 1509-1516, October, 1980. 10 Fig, 6 Tab, 14 Ref.

Descriptors: *Biodegradation, *Ozone, *Surfactants, Water treatment, Oxidation, p-Toluenesulfonic acid, Model studies, Chemistry, Organic compounds.

The reaction of p-toluenesulfonic acid (PTA) with ozone was studied at initial levels of pH 3 and 12 in aqueous solutions. The initial concentration of PTA was 1 mmol/l. The substrate elimination followed a zero order rate law. A 98% reduction in PTA required at least 7 mol ozone/mol PTA. To remove all the PTA the consumption of ozone increased to 16 mmol/mmol PTA. A 28% reduction in DOC and 74% reduction of COD resulted at this concentration of ozone. At higher ozone flow rates the PTA decomposition was quicker. However, the specific ozone consumption also increased. Methylglyoxal, acetic acid, formic acid, pyruvic acid, oxalic acid, sulfuric acid and hydrogen peroxide were identified as oxidation products. Mesoxalic acid was identified as a byproduct. Lactic acid was a further oxidation product at pH 12. A possible reaction mechanism is described, which suggests that ozone treatment can be used to enhance degradation of nonbiodegradable organics. (Baker-FRC)
W81-01853

THE INFLUENCE OF SLUDGE AGE ON HEAVY METAL REMOVAL IN THE ACTIVATED SLUDGE PROCESS,
Imperial Coll. of Science and Technology, London (England). Dept. of Public Health Engineering.
R. M. Sterritt, and J. N. Lester.
Water Research, Vol 15, No 1, p 59-65, January, 1981. 5 Fig, 1 Tab, 29 Ref.

Descriptors: *Heavy metals, *Activated sludge, Biochemical oxygen demand, Sludge, Trace elements, Metals, Suspended solids, Effluent, *Sewage treatment, Water pollution.

A laboratory simulation of the activated sludge process was conducted to determine the influence of sludge age on heavy metals removal. Ten metals were added continuously to 6 sludge samples with ages between 3 and 18 days. Results demonstrated differences in the behavior of heavy metals which may be attributable to various factors, including affinity for solids, soluble complexing agents, and chemical oxygen demand. The highest removal efficiencies for most metals occurred at the 15 day sludge age. Cobalt, manganese, and molybdenum removals were poor; chromium and cadmium removals were consistently highest, with efficiencies greater than 50%. (Titus-FRC)
W81-01854

THE INACTIVATION OF FAECAL COLIFORMS AND ASCARIS OVA IN FAECES BY LIME,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Environmental Engineering.
C. Polprasert, and L. G. Valencia.
Water Research, Vol 15, No 1, p 31-36, 1981. 4 Fig, 2 Tab, 21 Ref.

Descriptors: *Sewage bacteria, *Worms, *Lime, Microorganisms, *Coliforms, *Water treatment, Calcium compounds, Sampling, Oxides, Hydrolysis, Chemical degradation, Fertilizer, Sludge, *Thailand.

The inactivating effect of lime on fecal microorganisms was investigated during a pilot project in Thailand. Human fecal samples were dosed with lime slurry and analyzed over a 48 hour period for pH, coliforms, and the presence of Ascaris ova. Results indicate that in sufficient quantities lime can be effective in inactivating coliforms. Insignificant effects are observed with a pH of 9. In all cases the contact time of 3 hours was sufficient. Results indicate ovicidal effects on Ascaris at a low efficiency. The application of lime as a disinfectant may be a useful, low-cost method of reducing disease in developing countries. (Titus-FRC)
W81-01855

BIOLOGICAL DENITRIFICATION IN AN UPFLOW SLUDGE BLANKET REACTOR,
Agricultural Univ., Wageningen (Netherlands).
K. Klapwijk, J. C. M. van der Hoeven, and G. Lettinga.
Water Research, Vol 15, No 1, p 1-6, January, 1981. 4 Fig, 4 Tab, 16 Ref.

Descriptors: *Sludge treatment, *Nitrates, *Dentrification, Solids contact processes, Flow, *Nutrient removal, Waste treatment, Activated sludge, Biodegradation, Sands, particle size, Velocity, Sewage effluents, Suspended solids.

Upflow sludge blanket reactors with no carrier medium can be used for nitrate removal. Studies using fusel oil surface loading of 2 meters/hectare produced sludge concentrations of 40 grams of total solids per liter. Higher loads are believed to be attainable. The minimum nitrate removal rate obtained was 500 grams per cubic meter per hectare. The sludge blanket reactor requires no effluent recycling. In addition, it reduces the escape of suspended solids and carrier particles because it fluidizes sludges at lower velocities than conventional sand bed reactors. (Titus-FRC)
W81-01858

A COMPARISON OF THE CHARACTERISTICS OF SOLUBLE ORGANIC NITROGEN IN UNTREATED AND ACTIVATED SLUDGE TREATED WASTE WATERS,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
G. F. Parkin, and P. L. McCarty.
Water Research, Vol 15, No 1, p 139-149, January, 1981. 5 Fig, 5 Tab, 36 Ref.

Descriptors: *Waste water treatment, *Nitrogen compounds, *Activated sludge, Biological treatment, Organic compounds, Chemical oxygen demand, Hydrogen ion concentration, Adsorption, Activated carbon, Separation techniques, Cation exchange, Chromatography, Amino acids, Anion exchange.

The characteristics of soluble organic materials containing nitrogen (SON) in untreated waste waters and activated sludge effluents were studied using low microbial seed biodegradation evaluation, filtration chromatography for molecular weight distribution, activated carbon and ion exchange to determine removal, and analyses for free and combined amino acids. Activated sludge effluent SON was more refractory than untreated waste water SON. SON produced biologically during treatment had decay rates that were similar to those of SON in municipal activated sludge effluents and was 20-100% refractory. Less than 10% of the SON in municipal activated sludge effluent was made up of free or combined amino acids. About 15-30% were thought to be nucleic acid degradation products. Of the SON and soluble chemical oxygen demand (SCOD), 50-60% had apparent molecular weights (AMP) of less than 1800. Treated and untreated waste waters had similar AMP. The excess SON generated during activated sludge start-up contained considerably more SON with molecular weights greater than 1800. SON and SCOD were efficiently adsorbed from treated and untreated waste waters and from biologically produced organics by activated carbon. A significantly greater amount of SON was removed by cationic exchange from all waste waters tested at pH 2.0 than at pH 9.5. At pH 2.0, cationic exchange selectively removed more biologically produced SON relative to SCOD. (Geiger-FRC)
W81-01862

RESOLUTION OF AN INDUSTRIAL WASTE DILEMMA,
Quicksall (W. E.) and Associates, Inc., New Philadelphia, OH.
For primary bibliographic entry see Field 5C.
W81-01879

CONTROLLING AMMONIA IN WASTE WATER EFFLUENTS: A DISCUSSION,
Metropolitan Sanitary District, Chicago, IL.

W. L. Munch.
Public Works, Vol 111, No 6, p 140-142, June, 1980. 3 Ref.

Descriptors: *Ammonia, *Waste water treatment, Nitrification, Sludge treatment, Nitrogen compounds, Retention time, Evaluation.

This article makes reference to a previous publication dealing with the theoretical aspects of biological nitrification. The current author cites confusion arising out of the incorrect usage of the terms 'solids retention time' and 'solids wasting rate'. The current author states that wasting rates should not be kept as low as possible, but should be rationally determined based on a target solids retention time which reflects the various conditions of the system. Sludge wasting rates must be high enough to maintain MLSS concentration within the solids handling capacity of the clarifiers. The solids retention time should also be selected so that it is the lowest which will safely sustain nitrification under the most severe anticipated conditions. The author states that in order to control nitrification processes, especially single-stage ones, a full understanding of their requirements and potential problems is necessary. (Baker-FRC)
W81-01881

A CASE STUDY OF COMPUTERIZED INDUSTRIAL WASTE DATA,
Metropolitan District Commission, Boston, MA. Sewerage Div.
For primary bibliographic entry see Field 7C.
W81-01887

DRAINAGE BASIN CONTAMINATION PROMPTS REGIONAL PLANNING,
CH2M/HILL, Redding, CA.
S. A. Smith, and C. D. Gardner.
Public Works, Vol 111, No 5, p 76-77, 130, May, 1980. 2 Tab.

Descriptors: *Regional planning, *Water pollution control, *Earthquake engineering, *Treatment facilities, *Sewage treatment, Oroville, Thermalito, North Burbank(CA), California, Waste water treatment, Feather River(CA), Salmon, Fish, Municipal wastes, Construction costs, Sewage effluents.

Pollution problems in the Feather River, California, were solved after a sewage treatment plant was designed and built by the Sewerage Commission Oroville Region (SCOR), composed of 3 communities, Oroville, North Burbank, and Thermalito. Total construction costs were $7.4 million. Much of the existing facility at Oroville was incorporated into the new plant. The structure was designed to be earthquake resistant and has resisted quakes registering 7.5 and hundreds of aftershocks. The Feather River salmon population is protected from pollution by discharging treated effluent 5 miles below spawning grounds. Fingerling trout are used to monitor the toxicity of the effluent. An emergency storage pond with capacity for 2 days' flow is available for excess flows or emergencies. Operation and maintenance costs for the 1978-1979 fiscal year were $259,000, equal to 30 cents per thousand gallons. (Cassar-FRC)
W81-01889

EXPERIMENTAL LAND TREATMENT SYSTEM PROCESSES MINE DRAINAGE.
Public Works, Vol 111, No 2, p 91, February, 1980.

Descriptors: *Acid mine water, *Coal mine wastes, *Lime, *Waste water treatment, Water pollution sources, Acid streams, Water pollution, Mine drainage, Mine wastes, Filtration, Hydrogen ion concentration, Streams, Watersheds, Pennsylvania, Iron, Appalachian Mountain region.

In Appalachian Pennsylvania, where acid mine drainage has destroyed the biological activity of many streams, research is being conducted on a low cost system to treat acid mine drainage before returning it to the watershed. The Loyalhanna Watershed Association is using lime treated forest soil to remove dissolved iron and sulfuric acid from water flowing out of an abandoned coal mine which has been polluting Laurel Run, a tributary of Loyalhanna Creek. Lime treatment is performed in three earthen lagoons covering a half acre plot. The living filter principle is applied as limed soil treatment, wherein soil microorganisms act to cleanse the wastes before the water is returned to the main stream. Mixed results have been reported for the project so far. While level of iron in the mine drainage has been reduced, no significant decreases in pH values have been observed. To help decrease the pH of the mine drainage stream, less water will be released into the treatment lagoons, and the amount of lime used will be increased. (Geiger-FRC)
W81-01897

5E. Ultimate Disposal Of Wastes

EFFECTS OF ENVIRONMENTAL VARIABLES AND SOIL CHARACTERISTICS ON VIRUS SURVIVAL IN SOIL,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5B.
W81-01771

ENGINEERING EVALUATION OF NEW SLUDGE TREATMENT FACILITIES,
Japan Sewage Works Agency, Saitama. Research and Technology Development Div.
K. Ohmiya, and S. Takahashi.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 943-949, May, 1980. 4 Fig, 6 Tab.

Descriptors: *Sludge treatment, *Treatment facilities, Evaluation, Technology, Heating, Incineration, Dewatering, Sludge disposal, *Japan, Steam-heated screw press, Carver-Greenfield process.

New facilities and equipment related to sludge treatment that have recently been put on the market in Japan are evaluated. A steam-heated screw press has been installed at a dewatering plant. Conditioned sludge is dewatered and gradually compressed by a screw turning at 0.1 to 0.2 rev/min and further compressed by a compression ring. The steam heats the sludge to 40 to 70 degrees C, and quicklime is used as a coagulant. Various process parameters are given, and a disadvantage of the new system, odor of heated sludge, is explained. The Carver-Greenfield process, which uses triple-effect evaporators to dewater sludge and a boiler to incinerate dry sludge, is described. This process has lower operating and capital costs compared to conventional systems. A pilot-scale smelting furnace plant heated with an oil burner has been developed which is capable of processing sludge cake at a rate of about 800 kg/hour. Because the slag can be used as a filler like sand in sewer construction, this new method has gained attention. (Small-FRC)
W81-01796

SETTLING PROPERTIES OF EXTENDED AERATION SLUDGE,
Department of Health, Johannesburg (South Africa).
A. R. Pitman.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 524-536, March, 1980. 12 Fig, 5 Tab, 21 Ref.

Descriptors: *Sludge, *Settling velocity, *Suspended solids, *Activated sludge, Aeration, Dissolved oxygen, Nutrients, Nutrient removal.

The settling properties of activated sludges from two extended aeration plants and an activated sludge plant designed for biological nutrient removal were investigated. An apparatus was developed to measure settling properties using multiple batch settling tests. The relationship between sludge settling velocity and solids concentration followed a straight line on log-log graph paper. The results of this investigation can be used to optimize plant operation. Well-operated extended aeration activated sludge plants running at long sludge ages (15 to 20 days) can produce sludges with settling properties comparable to those of pure oxygen plants. Dissolved oxygen levels can not be allowed to drop to levels where filamentous growth is favored. Operation of a biological nutrient removal activated sludge plant risks the occurrence of slow-settling filamentous sludges, especially when the non-aerated zones make up a large proportion, more than 20%, of the main tank volume, and dissolved oxygen levels are suppressed. (Small-FRC)
W81-01813

ENERGY AUTONOMY IN THE WASTE WATER TREATMENT PROCESS,
Societe Degremont, Rueil-Malmaison (France).
J. Bernard, and P. DaVia.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 587-596, March, 1980. 6 Fig, 6 Tab.

Descriptors: *Energy, Conservation, *Treatment facilities, Anaerobic digestion, *Sludge disposal, Incineration, Costs.

Energy recovery in waste water treatment plants is discussed. Energy recovery is possible through anaerobic digestion of sludge and sludge incineration. Electromechanical recovery during anaerobic digestion can be achieved by means of intermediate internal combustion dual-fuel-type engines. While the output of the dual engines is relatively low, 30-40% of the energy spent can be recovered in the form of hot water from the cooling circuits and exhaust gas. The real output of energy transformation is actually about 50%. When fresh sludge is to be disposed of by incineration, the best energy recovery is obtained when the sludge is dewatered. Currently, energy recovery costs almost as much as buying energy. However, this may change as energy deficiencies grow. Also, an energy autonomous plant has the advantage of being independent of energy sources and may be located without regard to these sources. (Small-FRC)
W81-01818

SOLIDS HANDLING SYSTEMS FOR SIX DIFFERENT DISPOSAL OPTIONS,
Metropolitan Sanitary District of Greater Chicago, IL. Maintenance and Operations Dept.
R. R. Rimkus, E. W. Knight, and G. E. Sernel.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 740-749, April, 1980. 2 Fig, 7 Tab, 5 Ref.

Descriptors: *Sludge disposal, *Fertilizers, *Costs, Illinois, Cities, Drying, Land reclamation, Sludge digestion, Sewage sludge, Composting, *Solid waste disposal.

Six solids disposal management options practiced by the Metropolitan Sanitary District of Greater Chicago are reviewed. Nu Earth, a waste water solid that has been digested anaerobically and air dried for several years, is given away by the truckload. Nu Earth is compost-like material resembling rich soil and is acceptable for flower and landscape gardening. Heat-dried fertilizer, an excellent soil conditioner, is sold to a broker by competitive bid. Waste activated solids are conditioned with ferric chloride, dewatered by vacuum filters, mixed with dry solids, and heated to approximately 700C to produce the fertilizer. Some waste solids are digested in heated anaerobic digesters for 14 days and applied to land which was previously strip-mined. Other waste solids are aged in lagoons after heated digestion and then distributed free to the public or disposed of by a contractor. Since 1977, some solid wastes have been composted as part of a research program. Fertilizer production, land reclamation, and composting are the most costly of the six methods studied. (Small-FRC)
W81-01830

ALTERNATIVE FUELS FOR MULTIPLE-HEARTH FURNACES,
Brown and Caldwell, Walnut Creek, CA.
B. D. Bracken, and T. U. Lawson.

Journal of the Water Pollution Control Federation, Vol 52, No 4, p 791-803, April, 1980. 4 Fig, 9 Tab, 7 Ref.

Descriptors: *Energy, *Cost-benefit analysis, *Fuels, *Sludge treatment, Feasibility studies, Dewatering, Incineration, Alternative fuels, Energy conservation, Australia.

The reduction or elimination of fuel oil requirements for multiple hearth furnaces at the Lower Molonglo Water Quality Control Centre (Australian Capital Territory near Canberra) was investigated. The furnaces are used to effect sludge volume reduction and recover lime for reuse in the treatment process. It was technically feasible to fire refuse-derived fuel, waste paper, wood chips, or coal in the furnaces as a partial or total substitute for fuel oil (No. 2). Also, fuel oil consumption could be minimized by reducing sludge water content by either dewatering sludge in filter press or drying it with a rotary drier using furnace offgases. Either using a waste fuel or reducing sludge moisture will require modifications to the plant, and for some waste fuels, the construction of additional waste processing facilities would be necessary. The costs of the additional required facilities would offset any potential savings in fuel costs. A cost analysis indicated that none of the solid-fuel alternative schemes would be cost effective in comparison with the existing fuel-oil fired operation through 1989. A sludge drying operation would be cost effective by 1985 if afterburning was not required. (Small-FRC)
W81-01832

SINGLE-SLUDGE PURE-OXYGEN NITRIFICATION AND PHOSPHORUS REMOVAL,
Calocerinos and Spina, Syracuse, NY.
R. A. Clarkson, P. J. Lau, and D. J. Krichten.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 770-779, April, 1980. 6 Fig, 7 Tab, 6 Ref.

Descriptors: *Nitrification, *Sludge treatment, *Phosphorus removal, Performance, Biochemical oxygen demand, Lime, Ferric chloride, Alum polishing.

A pilot-plant program to obtain design criteria for single-sludge, pure-oxygen nitrification and compatible methods of oxygen removal is reviewed. The Morgan Road pilot plant study (Morgan Road Treatment Plant in Onondaga County, New York) had two phases. Phase I investigated FeCl2 and lime addition to primary and oxygen activated sludge nitrification. Phase II investigated oxygen activated sludge nitrification and alum polishing. Total system performance was 95% or greater for the removal of BOD5, NH3-N, and total suspended solids for all steady-state periods. Final effluent total phosphorus concentrations were maintained at less than 1.0 mg/liter over the same period. Over 90% of the BOD and NH3-N were removed by the nitrification system with a 2-hour influent detention time, at 20 and 13 degrees C, and after primary clarification with lime and ferric chloride. The nitrification system was successful in removing over 90% of the BOD and NH3-N with a 4-hour detention time at 13 degrees C when treating raw degritted waste water. Phosphorus was removed to less than 1 mg/liter by ferric chloride and lime addition before the primary clarifier. The lime was found to both buffer the nitrification system pH and remove phosphorus to an extent that minimized the dosage of ferric chloride required. (Small-FRC)
W81-01834

COMPOSTING AND DISPOSAL OF INDUSTRIAL WASTE WATER SLUDGE,
Alexander Potter Associates, New York.
P. A. Nese, J. Galandak, and J. A. Frederick.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 183-191, January, 1980. 1 Fig, 8 Tab, 1 Ref.

Descriptors: *Sludge treatment, *Biodegradation, *Soil disposal fields, *Sludge disposal, Industrial wastes, Heavy metals, Costs, Regulation, Performance.

A sludge management plan for the highly industrialized northern New Jersey area includes composting of the sludge and deposit on non-agricultural lands. As an alternative to the now illegal ocean dumping, sludge composting has the lowest capital and operating costs, and it satisfies the EPA requirement that beneficial use be given preference. However, the sludge includes heavy metals from industrial sources which make beneficial use difficult. For example, existing sludge contains 4332 mg/kg of zinc, while the NJDEP limit is 2500 mg/kg. An 18-day sampling program also found excessive levels of copper, nickel, cadmium, and chromium. Pyrolysis and land application were considered as alternatives to ocean dumping, but composting with the addition of wood chips to dilute the heavy metals was the most attractive alternative. A study is needed to see if the resulting composted product could be marketed, as similar compost is in several locations. The high heavy metal concentrations may eliminate this possibility. (Small-FRC)
W81-01842

DEVELOPING A COST-EFFECTIVE SLUDGE MANAGEMENT APPROACH,
Proctor-Davis-Ray, Inc., Lexington, KY.
C. R. Scroggin, D. A. Lewis, and P. B. Danheiser.
Public Works, Vol 111, No 6, p 87-91, June, 1980. 2 Fig, 3 Tab.

Descriptors: *Ultimate disposal, *Sludge disposal, *Composting, Fertilizers, Planning, Waste disposal, Municipal wastes, Incineration, Agriculture, Cost analysis, Feasibility studies, West Hickman Creek Waste Water Treatment Plant, Kentucky, Soil amendments.

An interim sludge management program was proposed after studying four alternatives for the West Hickman Creek Waste Water Treatment Plant, Kentucky. Continued land application of anaerobically digested sludge was recommended. Several capital expenditures suggested were a high flotation tire equipped applicator, belt filter press, and a bridge to provide truck access. It was recommended that liquid slude be applied as frequently as possible, with back-up storage facilities available for unfavorable weather. Careful attention to application rates and groundwater monitoring were mentioned. A cost-effective, long-range disposal plan includes gravity thickening of combined primary and waste activated sludge, anaerobic digestion with utilization of resulting methane gas, chemical conditioning with polymers, dewatering by continuous belt filter press, and composting for use as a soil conditioner. (Cassar-FRC)
W81-01888

CODISPOSAL OF REFUSE AND SLUDGE,
Cosulich (William F.) Associates, Woodbury, NY.
W. F. Cosulich.
Public Works, Vol 111, No 8, p 66-69, August, 1980. 7 Fig.

Descriptors: *Sludge disposal, *Incineration, Disposal, Coburning, Ultimate disposal, Cost estimates, Waste disposal, Municipal wastes.

Methods of coburning sewage sludge and municipal refuse are described. This process may be useful where other disposal systems are costly. The most successful method to date involves coburning unprepared refuse and dewatered sludge in a waterwall or refractory incinerator. Experiences at several European cities are detailed. Plans for U.S. installations using this method are being implemented in Harrisburg, Pa., and Glen Cove, N. Y. Another variation, which coburns refuse-derived fuel in a multiple hearth with limited air, has occasional problems with poor temperature control, hearth erosion, refractory failures, and air pollution. A process using refuse-derived fuel and sludge coburned in a fluidized bed incinerator experienced difficulties with economics and reliability. Unprepared refuse and sludge can also be burned in a modular starved air incinerator. Selection of an optimum method depends upon local costs for energy and sludge-refuse disposal. (Cassar-FRC)
W81-01893

5F. Water Treatment and Quality Alteration

TRIHALOMETHANES: IMPACT OF BROMIDE ION CONCENTRATION ON YIELD, SPECIES DISTRIBUTION, RATE OF FORMATION AND INFLUENCE OF OTHER VARIABLES,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W81-01656

ENGINEERING ANALYSIS OF THE COST/BENEFIT RELATIONSHIP FOR RURAL WATER SUPPLY TREATMENT SYSTEMS,
Missouri Univ.-Columbia. Dept. of Engineering.
G. D. Reed, T. Brown, and L. Dixson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173759, Price codes: A05 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri Completion Report, October 17, 1980. 83 p. OWRT-A-118-MO(1), 14-34-0001-0127.

Descriptors: *Water treatment, *Cost-benefit ratio, *Rural areas, *Missouri, Optimization, Economics, Treatment facilities, Water districts, Water supply, Computer models.

Rural water supplies have experienced chronic water quality problems which often have been traced to basic management decisions which were made without cost/benefit information to provide viable alternatives. A program was developed based on recent cost data for a wide range of treatment and quality conditions. The program was written in a format which can be used by individuals who are not technically knowledgeable but responsible for management decisions. The program was written in basic so that the user could disect the solution at critical option points. With this information, the user can either obtain treatment estimates for several potential changes and continue working on those which are advantageous or acquire cost information for future budgeting purposes.
W81-01691

EXPERIENCES IN THE USE OF OZONE,
North West Water Authority (England). Eastern Div.
K. A. Sankey, and P. Whatmough.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 5, p 435-452, 1980. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Ozone, *Water treatment, *Reviews, Pilot plants, Disinfection, Economics, Water quality, Color, Operations research, Maintenance, Operating costs, Electric power costs, Equipment, Toxicity, Safety, Watchgate Plant(UK), *United Kingdom.

The performance, safety and economics of the Watchgate Treatment Plant, which uses ozone in the treatment of water from the Haweswater Reservoir, United Kingdom, are examined. No major problems of plant performance were encountered when pilot scale operations were converted to full scale ozone treatment processes. Ozone was used in a continuous process rather than intermittently to control color and disinfect water supplies. The equipment performance has been generally good. Electrical equipment, heat exchangers, refrigerators, ozonizers and vent gas absorbers all required minimal maintenance. Safety precautions must be executed when working with ozone due to its toxicity. Electrical energy constitutes the major cost of ozone plant operation, but all of the electrical requirements may be met from local sources. No special labor skills are needed to operate an ozone treatment facility other than those required in the usual large water treatment plant. Many of the corrosion problems associated with ozone may be alleviated with the use of polyvinyl chloride pipework. Carbon adsorption of vent gas has been useful in preventing corrosion of disposal ducts.

No problems with water quality have occurred at the Watchgate plant, which supplies 800 thousand people and many industries with strict water quality requirements. Proper operation of an ozonizer will take place only in a very dry atmosphere; therefore, dewpoint analyzers are essential to the Watchgate ozone treatment housing. Methods for monitoring ozone levels in gaseous or dissolved form are also discussed. (Geiger-FRC)
W81-01693

PROCESS AND APPARATUS FOR THE THOROUGH PURIFICATION OF WATER AND THE HIGHLY PURIFIED WATER OBTAINED THEREBY,
Institut Pasteur, Paris (France). (Assignee).
H. S. Marcovich, and R. D. Perrin.
U.S. Patent No 4,202,736, 7 p, 1 Fig, 2 Tab, 5 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 615-616, May 13, 1980.

Descriptors: *Patents, *Water treatment, *Water purification, *Water quality control, Heat, Evaporation, Condensation, Distillation, Equipment, Super heat, Apyrogenic water.

An object of the invention is to provide a process for obtaining water practically devoid of organic residues by a one-step process. In addition an object is to provide a process and apparatus enabling production of entirely reliable highly purified water which is suitable for the most exacting requirements of modern biology. The water is heated to convert it into steam; the steam is passed from a container into a superheating zone and then condensed in the form of purified water. The superheating zone contains at least in part, a packing of a material inert with respect to steam and impurities possibly present in the latter. The steam is superheated in this zone by means of supplementary heating to a temperature exceeding 300 degree C, and reaching notably from 400 degree to 700 degree C, preferably from 500 degree to 700 degree C. Highly purified apyrogenic water freed from undesired organic substances is produced by this process. (Sinha-OEIS)
W81-01730

QUANTITATIVE STUDIES ON A HUMAN PATHOGEN (CANDIDA ALBICANS) AND TRADITIONAL BACTERIAL INDICATORS OF POLLUTION IN DOMESTIC WASTE WATERS AND RECEIVING WATERS,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5A.
W81-01762

REPORT ON WATER LOSSES,
E. C. Reed.
Aqua, No 8, p 0178-0191, 1980. 5 Fig, 7 Tab, 5 Append.

Descriptors: *Water loss, *Leakage, *Potable water, Water conveyance, Pipes, Conduits, *Water distribution(Applied), Public utilities.

Data on water losses from distribution systems were summarized from information received from 81 towns in 15 countries. Of total leakage from supply systems, an average of 64% is from water mains, 33% from service pipes and customer premises, and 3% from reservoirs. Cost of water, and not metering was a decisive factor in consumption and in existence of leakage control programs. Methods of leakage control and detection and the percentages of towns using these methods are as follows: response only to complaints or problems, 29%; regular leak sounding, 41%; district flowmeters, 4%; and waste metering, 26%. Most detection methods involve a listening device. The most frequent factors causing leaks were soil movement, pipe corrosion, heavy traffic, high pressure, and excavations. (Cassar-FRC)
W81-01773

POTENTIAL OF TUBE SETTLERS IN REMOVING RAW WATER TURBIDITY PRIOR TO COAGULATION,
Mosul Univ. (Iraq). Environmental Engineering Div.
S. Ahmad, and M. T. Wais.
Aqua, No 8, p 0166-0169, 1980. 6 Fig, 2 Tab, 14 Ref.

Descriptors: *Tube settlers, *Water treatment, *Turbidity, Coagulation, *Tigris River(Iraq), Settling velocity, Sedimentation rates, Suspended solids, Iraq.

A 2.6 cm tube settler removed as much as 85% of turbidity from raw Tigris River water at a flow rate of 4.1 cm per minute in a pilot study designed to test the effectiveness of tube settlers on removal of sand, silt, and clay in water prior to coagulation. Flow velocity was the most significant variable. Turbidity removal decreased with increasing flow velocity, with a sharp decrease in efficiency beyond 30 cm per minute. Tube diameter and its interaction with flow velocity was very significant. Optimum tube inclination was 40 degrees. Turbidity removal increased to 60%, remained constant until 80%, then decreased as the ratio of tube length to diameter increased. (Cassar-FRC)
W81-01775

CONTROLLING TASTE AND ODOUR LEVELS IN WATER,
A. J. Bowers.
Water and Pollution Control, Vol 118, No 12, p 14-16, December, 1980. 1 Tab, 3 Ref.

Descriptors: *Taste, *Odor control, *Potable water, Water purification, Water quality, Water pollution effects, Chlorination, Ozone, Activated carbon, *Water treatment.

Control of undesirable taste and odor problems in drinking water is attacked on two fronts--prevention of initial odor development and treatment to reduce odors present. A water source may be protected by reducing industrial discharge, improving the quality of sewage effluents, locating intakes where water quality is unaffected by weather conditions or contamination, using coagulation and flocculation prior to chlorination in the treatment plants, cleaning treatment plant equipment regularly, and maintaining the distribution system properly. If tastes and odors appear in finished water, possible alternatives to chlorination are chlorine dioxide and ozone. Activated carbon may be used to eliminate a large number of tastes and odors. A case study of a 3-day taste and odor problem in a sourthern Ontario municipality illustrates the cost of these problems: 2 million gallons of waste processed water, $1,000 for chemicals, and $6,000 for manpower. (Cassar-FRC)
W81-01850

WATER QUALITY IMPROVEMENT PROGRAM,
D. W. Fitzpatrick.
Public Works, Vol 111, No 5, p 74-75, May, 1980.

Descriptors: *Water quality control, *Polychlorinated biphenyls, *Trihalomethanes, Potable water, Municipal water, *Poughkeepsie(NY), New York, Corrosion, Lead, Water analysis, Chlorination, Activated carbon, Water purification.

The City of Poughkeepsie, N.Y., is pursuing plans to improve the quality of drinking water for its 65,000 customers. There are three major problems. The low level of polychlorinated biphenyls (PCB's) present in water and sediments of the raw source, the Hudson River, will be removed with a post-filtration carbon adsorption system if test results indicate this process will be beneficial. A $112,800 mid-point chlorine injection system is being installed to reduce the amount of trihalomethane formation. Work is being done on a caustic feed process to increase pH in the distribution system so that lead from older pipes will not dissolve into the water. Analytical equipment and personnel have been added to the facilities. A public relations brochure has been issued to increase the consumers' awareness of problems and solutions. It discusses the problems of PCB's, trihalomethanes, and corrosivity. (Cassar-FRC)
W81-01890

FINDING THE RIGHT RX FOR TASTES AND ODORS,
York Water Co., PA. Purification Dept.
D. R. Barnhart.
Public Works, Vol 111, No 6, p 95-96, 130, June, 1980. 1 Tab.

Descriptors: *Taste, *Odor, *Eutrophication, *Algicides, *Water quality, *Water treatment, Reservoirs, Pennsylvania, Water purification, Water pollution, Farm wastes, Activated carbon, Copper sulfate, Chlorination, Potassium permanganate, Nutrients.

Consumers of the York, Pa., Water Company, formed in 1816, experienced the first taste and odor problem in the memory of the system beginning in December, 1973. Algae were in full bloom in the ice-covered reservoirs. Neither activated carbon adsorption nor reducing raw water chlorination was effective in eliminating complaints. Increasing prechlorination residuals to 1-1.25 mg per liter finally reduced odor and taste to acceptable levels. When lake ice had melted, copper sulfate treatment was undertaken. Subsequent blooms were controlled with potassium permanganate until July 1975, when severe algae problems again developed. Odors experienced at various times were described as fishy, muskmelon, cucumber, grassy, earthy, and moldy. Although copper sulfate treatment improved the water quality in about 72 hours, blooms continued for 3 more years. Anabaena and Aphanizomenon had the greatest resistance to treatment. A sampling program and regular copper sulfate treatment have controlled problems since 1975. Possible causes of the elevated nutrient levels, which reach as high as 15 mg per liter, are rotting vegetation in Lake Redman (completed only 6 years before the initial problem) and heavy input of chicken manure into a tributary upstream during 1973. (Cassar-FRC)
W81-01894

HOW TO CONDUCT A GAC ORGANICS REMOVAL PILOT STUDY,
J. L. Fisher.
Public Works, Vol 111, No 6, p 100-102, June, 1980. 3 Fig.

Descriptors: *Activated carbon, *Adsorption, *Water purification, *Organic compounds, Design criteria, *Pilot plants, Water treatment, Water pollution treatment, Trihalomethanes.

Granular activated carbon systems for removing trace organic materials, such as trihalomethanes, from water supplies should be tested in pilot plant studies before designing a full-scale system. Laboratory-obtained adsorption isotherms are not completely applicable to full-scale rates of adsorption. A satisfactory pilot plant should be constructed of stainless steel, brass, teflon and/or glass to minimize organic contamination. Typically, 4 glass columns are used, 5 feet long and 4 inches in diameter, with pressure gauges and relief valves. Six inches of graded gravel is placed in the bottom of the column, and activated carbon in the remainder. The following parameters are monitored: temperature, pH, flow rate, suspended solids level, contaminant level, turbidity, and total organic carbon level. Although the column break-through curve is the most commonly used statistical tool, other methods may include carbon dosage rate curves, mass transfer zone determination, and adsorption capacity calculations. Design criteria obtainable from a field pilot study include effect of various contact times, optimum carbon bed depth, effect of hydraulic loading, number of vessels needed, type of activated carbon needed, carbon life/changeout frequency, carbon exhaustion rate, and contaminant loading rates. (Cassar-FRC)
W81-01895

5G. Water Quality Control

SALMONELLA SURVIVAL IN FRESHWATER AND EXPERIMENTAL INFECTIONS IN GOLDFISH (CRASSUIS AURATUS),
Purdue Univ., Lafayette, IN. Dept. of Microbiology, Pathology and Public Health.

For primary bibliographic entry see Field 5A.
W81-01655

WATER-RESOURCES APPRAISAL OF THE SOUTH-ARKANSAS LIGNITE AREA,
Geological Survey, Little Rock, AR. Water Resources Div.
J. E. Terry, C. T. Bryant, A. H. Ludwig, and J. E. Reed.
Geological Survey Open-File Report 79-924, May, 1979. 162 p, 36 Fig, 50 Tab, 46 Ref, 1 Plate.

Descriptors: *Water resources, *Evaluation, *Water quality, *Lignite, *Arkansas, Groundwater, Surface waters, Water utilization, Available water, Strip mines, Water pollution sources, Coal mines, Chemical analysis, Data collections, *South Arkansas, *Baseline studies, Forecasting, Environmental effects.

The feasilbility of developing lignite resources in south-central Arkansas is an important question at the present time (1978). Part of the concern is related to the possible impacts that mining and processing of lignite will have on water resources. Not only will the disturbance caused by excavating affect the quantity and quality of surface and ground water, but the mining, processing, and conversion processes will require the use and consumption of significant quantities of water. To assess the magnitude of the effects of strip mining upon both surface and ground water, baseline conditions (hydrologic conditions in the area prior to mining) must be well defined. A thorough data file and literature search was made so that baseline conditions in the area could be defined. In addition, data-collection networks have been established for the collection of quantitative and qualitative information on streamflow and water levels in the aquifers. Data collected to date at these sites are included in the report. Collection of data at these sites will continue through at least September 1979. Information presented in this report can be used to estimate the quantities of water available for use and the possible effects of mining and associated dewatering on water resources. (USGS)
W81-01674

UNDERDRAIN FOR FILTER TANKS,
S. Kaufman.
U.S. Patent No 4,200,536, 4 p, 5 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1749, April 29, 1980.

Descriptors: *Patents, *Water treatment, *Water quality control, Filters, Filtration, Sands, *Backwashing, Sand filters.

Sand filters include filter beds of sand requiring frequent backwashing to free the beds from sludge or other material collected from the water. The backwashing operation is normally carried out by the introduction of clear water below the filter bed under sufficient pressure to thoroughly churn-up the sand and wash out the sludge. It has been found that underdrains currently used in sand filters fail to uniformly distribute the backwashed water. It is therefore an object of this invention to provide an underdrain for sand filters which effects a uniform distribution of backwash water through the filter bed. The underdrain assembly includes a central hub defining a chamber having sleeves radially extending and elongated hollow tubular elements extending outwardly of the sleeves. These elements have capped terminal ends, are of equal length, are spirally shaped and are equally spaced apart with their perforations being of equal size. Thus, the backwash water fed through the underdrain assembly is distributed uniformly through the filter bed. (Sinha-OEIS)
W81-01718

USE OF NONSTOICHIOMETRIC CARBON-SULFUR COMPOUNDS TO REMOVE COMPONENTS FROM LIQUIDS,
Exxon Research and Engineering Co., Florham Park, NJ. (Assignee).
D. W. Savage, C. H. Chang, and J. M. Longo.
U.S. Patent No 4,201,665, 19 p, 10 Fig, 8 Tab, 10 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 249, May 6, 1980.

Descriptors: *Patents, *Water treatment, *Separation techniques, Carbon, Sulfur, Adsorption, Waste water treatment, *Regeneration.

The invention relates to a process for removing organic and/or inorganic materials from aqueous and/or non-aqueous liquids by contact with nonstoichiometric carbon-sulfur compounds under adsorption conditions. Such compounds may be prepared by a variety of techniques including reacting a carbonaceous material at elevated temperatures with a sulfur-containing gas. Suitable carbonaceous materials from which C sub x S may be prepared include coal chars, conventional activated carbons, petroleum fluid coke, sucrose char, various polymeric chars and the like. The value of x is not critical and may range broadly. Spent C sub x S adsorbent may be regenerated thermally, by solvent extraction or by vapor stripping. (Sinha-OEIS)
W81-01724

DEPOSIT CONTROL THROUGH THE USE OF OLIGOMERIC PHOSPHONIC ACID DERIVATIVES,
Betz Lab., Inc., Trevose, PA. (Assignee).
L. W. Becker, P. S. Davis, and I. D. Morrison.
U.S. Patent No 4,201,669, 10 p, 10 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 250, May 6, 1980.

Descriptors: *Patents, *Water treatment, *Cooling water, Industrial water, Boiler feed water, Water quality control, Scaling, Demineralization, Recirculated water.

The invention is directed to aqueous systems such as, but not limited to, cooling water systems, pulp and paper mill systems, boiler water systems and gas scrubber systems where the formation and/or deposition of materials contained in them can and would most likely cause problems because of decreased flow rates, lost energy efficiency, poor quality products or pollution considerations. The problems associated with scale formation and deposition, the deposition of iron compounds, etc. in industrial water systems are well known. This disclosure is directed to oligomeric phosphonic acid derivatives which possess excellent chlorine resistance and acceptable calcium tolerance and which, at substoichiometric amounts, inhibit the formation of scale in aqueous mediums. Additionally, the oligomers have been found to be quite active as dispersants for particulate matter contained in an aqueous medium. (Sinha-OEIS)
W81-01727

PROCESS AND APPARATUS FOR THE THOROUGH PURIFICATION OF WATER AND THE HIGHLY PURIFIED WATER OBTAINED THEREBY,
Institut Pasteur, Paris (France). (Assignee).
For primary bibliographic entry see Field 5F.
W81-01730

BACKWASH WATER RECYCLING SYSTEM,
PepsiCo., Inc., Purchase, NY. (Assignee).
For primary bibliographic entry see Field 3E.
W81-01736

DETENTION BASIN SETTLEABILITY OF URBAN RUNOFF POLLUTION PHASE II,
Rutgers-The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., and J. V. Hunter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170474, Price codes: A03 in paper copy, A01 in microfiche. Final Technical Completion Report, Dec., 1980. 29 p, 9 Fig, 16 Ref. OWRT-A-058-NJ(2), 14-34-0001-0132.

Descriptors: *Detention reservoirs, *Water pollution control, *Storm runoff, *Sediment control, Water pollution, Pollution, Heavy metals, Oil pollution, Organic wastes, Coliforms, Sediment, Storm water, Settling basins, *Storm water management, *Dual purpose detention basins, *Settleability of pollutants.

Because of the growing interest in stormwater management, and particularly of the possibility of using detention basins for removing particulate pollution, it is important to determine the effectiveness of such basins for removal of various polluting substances. In a first phase of the present study samples of urban runoff were allowed to settle in a large tube, and the quantity of each pollutant settling in a given time period determined. There was more variability in rate of settlement of specific pollutants than for total suspended solids. Lead and hydrocarbons settled out 60-65% in 32 hours, only slightly slower than total suspended solids. BOD and copper were removed at somewhat lower rates, and zinc even lower. These results confirm the effectiveness of retention of stormwater in removing particulate pollutants. In the second phase of the study two detention basins were modified by constructing outlets so as to provide prolonged retention of stormwater; and observed trap efficiency of various pollutants was compared to computed trap efficiency and to the results of laboratory settleability of the same pollutants. Results indicate that laboratory settleability may be a useful tool in estimating probable effectiveness of dual purpose detention basins for the retention. (See also W80-04807)(Whipple-Rutgers)
W81-01756

CHIRONOMID FARMING-A MEANS OF RECYCLING FARM MANURE AND POTENTIALLY REDUCING WATER POLLUTION IN HONG KONG,
Chinese Univ. of Hong Kong, Shatin. Dept. of Biology.
P-C. Shaw, and K-K. Mark.
Aquaculture, Vol 21, No 2, p 155-163, October, 1980. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Diptera, *Water pollution control, *Pollution abatement, Farm wastes, Fish food organisms, Larvae, Insects, Recycling, Waste treatment, On-site investigations, Economic efficiency, Fertilizers, Cultures, Agriculture, Hong Kong.

In Hong Kong, chironomid larvae grown on chicken manure are being used for fish food in fish cultures and as live food for aquarium fish. It has been estimated that an area of 13.5 ha is used continuously for chironomid farming, producing over 85% of the country's chironomid larvae and using up 0.6% of the annual load of chicken manure. The manure would otherwise have been discharged into farm streams, causing serious pollution problems in local rivers. Field studies on a chironomid farm were conducted from February to June, 1979. Results showed that an average of three crops of larvae per field, totaling 139.0 kg, would yield approximately $458.6 in gross income based on the normal US wholesale price of $3.30/kg of larvae. Successful growth of chironomid larvae on chicken manure-enriched water in pans in plastic greenhouses has also been reported. The chironomid larvae are easily managed and pose no danger to human health. More chicken manure is consumed by farming chironomids than by fertilizing for agricultural purposes. Other farm wastes such as pig and sheep manure have also been tested for the culturing of chironomid larvae. Development of chironomid farms is seen as an economical method to help alleviate the pollution of streams by farm wastes. (Geiger-FRC)
W81-01776

LIMING ACID LAKES IN SWEDEN,
National Board of Fisheries, Goeteborg (Sweden).
B. Bengtsson, W. Dickson, and P. Nyberg.
Ambio, Vol 9, No 1, p 34-36, 1980. 7 Fig, 4 Ref.

Descriptors: *Lime, *Lakes, *Acidic water, Water pollution, Neutralization, Air pollution, *Sweden, Rivers, Aquatic microorganisms, Fish, Salmon, Perch, Aquatic life, Zooplankton, Phytoplankton.

In 1976 the Swedish government initiated liming lakes and rivers to improve the quality of water polluted by acid rains. During 1977-1979, 700 lakes

and rivers were treated directly with a total of 120,000 tons of lime. A single application may be effective for 5 to 10 years. Ecological studies showed that liming acid waters greatly increased the populations of zooplankton, phytoplankton, and fish. However, pH often decreases during periods of high water flow, such as snow melt, due to stratification. The present budget for the liming project is $2.5 million, about one tenth of the actual need. Proposed funds for 1980 and 1981 are $5 million and $7.5 million, respectively. (Cassar-FRC)
W81-01814

DESIGNING FOR FORCE MAIN ODOR CONTROL,
Cahn, Inc., Wallingford, CT. Process Systems.
M. A. Vivona.
Public Works, Vol 111, No 7, p 74-76, July, 1980. 2 Fig, 3 Tab.

Descriptors: *Odor control, *Water quality control, *Aeration, Sulfides, Sulfates, Biochemical oxygen demand, Water properties, Design standards.

A typical problem encountered in the attempt to control odor by force main air injection is explored and a solution is offered. Air injection must be planned in dependence on the reaction rate, assuming oxygen uptake from the air supplied. Factors involved in calculating the injection parameters include temperature, enzyme lag, carbonaceous and nitrogenous biochemical oxygen demand, and sulfate and sulfide equilibria. The design of the system must act in general to inhibit odor formation. This is accomplished by shifting the metabolism of microorganisms present from anaerobic to aerobic. Upstream treatment in collection systems involved an oxidant for odorous compounds, and/or a source of oxygen to defer anaerobic metabolism. The amount and rate of aeration required in a force main for odor control is determined by the oxygen reaction rate and the detention period at minimum flow. An example is given which demonstrates the means of determination of compressor capacity, power and operating energy requirements. The capacity of the compressor required is related directly to the capacity of the pump. The typical air injection pressure is usually between 5 and 10 psi higher than the force main pressure at the point of injection. Most standard compressors are rated at 100 psig. At lower pressures more air can be delivered at reduced power. At high compressor capacities diurnally programmed air feed should be considered. (Baker-FRC)
W81-01891

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

HYDROLOGY AND MODEL STUDY OF THE PROPOSED PROSPERITY RESERVOIR, CENTER CREEK BASIN, SOUTHWESTERN MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-01660

HYDROLOGIC ANALYSIS OF THE PROPOSED BADGER-BEAVER CREEKS ARTIFICIAL RECHARGE PROJECT, MORGAN COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
A. W. Burns.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-227887, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-46, July, 1980. 90 p, 44 Fig, 19 Tab, 30 Ref.

Descriptors: *Artificial recharge, *Project planning, *Model studies, *Hydrologic budget, *Colorado, Canals, Diversion, Water delivery, Ponds, Waterfowl, Flow augmentation, Surface-groundwater relationships, Aquifers, Water table, Water levels, Pumping, Available water, Hydrogeology, Projections, *Morgan County(CO), *South Platte River(CO), Badger Creek(CO), Beaver Creek(CO).

A hydrologic analysis of the proposed Badger-Beaver Creeks artificial-recharge project in Morgan County, Colo., was made with the aid of three digital computer models: A canal-distribution model, a ground-water flow model, and a stream-aquifer model. Statistical summaries of probable diversions from the South Platte River based on a 27-year period of historical flows indicate that an average-annual diversion of 96,000 acre-feet and a median-annual diversion of 43,000 acre-feet would be available. Diversions would sustain water in ponds for waterfowl habitat for an average of about five months per year, with a miximum pond surface area of about 300 acres with the median diversions and a maximum pond surface area of about 1,250 acres at least one-half of the years with the historic diversions. If the annual diversion were 43,000 acre-feet, recharge to the two alluvial aquifers would raise water levels sufficiently to create flowing streams in the channels of Beaver and Badger Creeks while allowing an increase in current ground-water pumping. The only area of significant waterlogging would be along the proposed delivery canal on the west edge of Badger Creek valley. If the total water available were diverted, the aquifer system could not transmit the water fast enough to the irrigation areas to avoid considerable waterlogging in the recharge areas. The impact of the proposed project on the South Platte River basin would be minimal once the ground-water system attained steady-state conditions, but that may take decades with a uniform diversion of the 43,000 acre-feet annually. (USGS)
W81-01670

WATER-RESOURCES APPRAISAL OF THE SOUTH-ARKANSAS LIGNITE AREA,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 5G.
W81-01674

ANALYSIS OF WATER RESOURCES PLANNING AND DECISION-MAKING PROCESSES AND OUTCOMES,
Policy Sciences Associates, Boulder, CO.
W. B. Lord, P. A. Bolton, J. A. Chase, and R. L. Cook.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170482, Price codes: A05 in paper copy, A01 in microfiche. Research Report 81-1, prepared for Office of Water Research and Technology, January, 1981. 71 p, 4 Fig, 12 Tab, 10 Ref, 4 Append. OWRT-C-80081-P(No 8404)(1), 14-34-0001-8404.

Descriptors: Planning, Decision making, Institutions, *Programs, *Governmental interrelations, *Project planning, Water policy, *Feasibility studies, Priorities, Planning objectives, Planning purposes, Goals.

Federal water resources planning can be conducted in different ways and can produce different outcomes. The purpose of this research project was to investigate how different ways of doing planning might lead to different outcomes, and to reveal the preferences for those outcomes which characterize persons who have participated in water resources planning within different federal programs and in different roles. Information on the outcome preferences of recent participants in planning within five different federal programs was collected through the use of nominal group and judgement analysis techniques. Information concerning planning process variants and their potential association with outcome attainment was collected through literature reviews and the use of panels of experts. The sampled participants placed a lower priority upon attaining national goals than other possible planning outcomes. Solving local problems is the outcome with highest priority, while resolving conflicts and improving public understanding are assigned intermediate priorities. There are substantial differences in how planning should be conducted, depending upon the outcomes desired. Clear and specific federal mandates, the use of instrumental rationality or consensus building as planning modes, and the selection of participants in the planning process are key variables. Hypothetical process-outcome models are provided.
W81-01755

WATER RESOURCES PLANNING USING COMPUTER GRAPHICS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
P. N. French, L. E. Johnson, D. P. Loucks, and D. P. Greenberg.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 21-42, March, 1980. 29 Fig, 4 Ref.

Descriptors: *Computer models, *Planning, Computer programs, Data processing, *Water resources development, Water management, Water quality control, Costs, Flood data, Flood forecasting, Graphical analysis.

Computer simulation and optimization models that are used to assist in multipurpose, multiobjective water resource planning often suffer from the lack of an efficient data input system and the lack of an easy yet comprehensive means of interpreting and communicating the results of model studies to others. These deficiencies may be minimized with the help of computer graphic input and display methods. Interactive computer graphics was applied to four planning problems, which included the prediction and management of water quality, multi-reservoir simulation for water supply, multiobjective analyses for reservoir sizing, cost and yields, and flood management. Tablet digitizing routines were frequently used to input spatial and other data, while the graphical output was accomplished by vector display methods. Visual feedback was obtained at all stages of the procedures. As the cost of computer memory declines, the use of the graphics input and display devices is expected to increase. (Geiger-FRC)
W81-01841

6B. Evaluation Process

POTENTIAL FOR USING THE UPPER COACHELLA VALLEY GROUND-WATER BASIN, CALIFORNIA, FOR STORAGE OF ARTIFICIALLY RECHARGED WATER,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-01663

DISSOLVED OXYGEN MEASUREMENTS IN OHIO STREAMS FOLLOWING URBAN RUNOFF,
Ohio State Univ., Columbus. Water Resources Center.
For primary bibliographic entry see Field 5B.
W81-01684

AN ECONOMIC ANALYSIS OF EFFLUENT STANDARDS FOR BOD, AMMONIA, TOTAL SUSPENDED SOLIDS, AND DISINFECTION: CASE STUDY OF A MODERN TREATMENT PLANT,
Donald L. Hey and Associates, Chicago, IL.
For primary bibliographic entry see Field 5D.
W81-01701

WATER USE, PROJECTED WATER REQUIREMENTS, AND RELATED DATA AND INFORMATION FOR THE STANDARD METROPOLITAN STATISTICAL AREAS IN TEXAS.
Texas Dept. of Water Resources, Austin Planning and Development Div.
Draft Report LP-141, August, 1980. 216 p, 30 Fig, 3 Tab, 2 Append, 1 Map.

Descriptors: *Texas, *Water resources planning, *Projections, *Water users, Comprehensive planning, Administration, City planning, Forecasting, Decision making, Management, Water allocation, Water management, Water resources development, Federal Water Pollution Control Act.

A presentation of current and projected water resources data and related information for each of the twenty-five Standard Metropolitan Statistical Areas (SMSAs) in Texas. Texas has fifteen major river basins and eight coastal basins which have approximately 3,700 designated streams and tributaries and more than 80,000 miles of streambed. Texans currently use about 17.5 million acre-feet of water per year, of which 12.2 million come from groundwater supplies. Most of the remaining surface water reserves are committed for foreseeable growth, and demands on the groundwater supplies are lowering water tables to the extent that major water supply problems are expected to occur in the foreseeable future. The SMSAs are depicted in relation to the river and coastal basins and are also cross-referenced on a map of the state to show the distribution of normal annual precipitation. A statewide perspective on water resources, their development and use, water quality planning and flood plain management is given. Each SMSA is analyzed in terms of present and future water use, planning, and management. The water supply outlook, problems, and possible solutions are discussed for the State as a whole and for each SMSA. (Garrison-Omniplan)
W81-01742

EMPIRICAL APPLICATION OF A MODEL FOR ESTIMATING THE RECREATION VALUE OF WATER IN RESERVOIRS COMPARED TO INSTREAM FLOW,
Colorado State Univ., Fort Collins. Dept. of Economics.
R. G. Walsh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170532, Price codes: A04 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report, December, 1980. 50 p, 7 Fig, 4 Tab, 65 Ref, 1 Append. OWRT-A-041-COLO(1), 14-34-0001-9006, 14-34-0001-0106.

Descriptors: *Water values, *Streamflow, *Reservoirs, *Recreation demand, Rivers, Evaluation, Economic feasibility, Cost analysis, Model studies, Value, Flow, Natural flow, Riverflow, Flow augmentation, Streamflow forecasting, River forecasting, Streams, Reservoir yield, Water supply, Reservoir sites, Reservoir operation, Reservoir yield, Recreation facilities, Recreation, Economics, Estimation, Colorado, *Rocky Mountain Region, Cold-water fishing.

Analysis was made of water value used for cold-water fishing at high mountain reservoirs/rivers located in the Colorado Rocky Mountains, which will contribute to an economic assessment of the tradeoff between providing recreational opportunities at high mountain reservoirs (HMR) and maintaining instream flow for river recreation use. Representative numbers (130) of fishermen were interviewed during the summer of 1978 at six sites (3 HMRs and 3 rivers), 6,000-10,000 feet in elevation. Willingness to pay was found to be contingent on changes in congestion and water level. Economic benefit functions were adjusted for crowinding, water level, access, participants' characteristics, and management costs. Providing access to 30% or 15% more HMRs would increase existing reservoir fishing benefits by an average of $3.27 or $1.25 per user-day, respectively, but once optimum capacity is reached, future expansion of fishing opportunities would be valued as average benefits of $10.26 and $11.78 per user-day on reservoirs and rivers respectively. Maximum benefits occur with an instream flow 35% of maximum flow. (Zielinski-IPA)
W81-01752

AGING URBAN WATER SYSTEMS: A COMPUTERIZED CASE STUDY,
Betz, Converse, Murdoch Inc., Plymouth Meeting, PA.
For primary bibliographic entry see Field 8A.
W81-01877

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

TREATED WATER DEMAND AND THE ECONOMICS OF REGIONALIZATION; VOLUME 2, ECONOMICS OF REGIONALIZATION: THE ELECTRIC POWER EXAMPLE,
Alabama Univ., University.
D. L. Hooks.
Environmental Protection Agency Report EPA-600/2-80-163, August, 1980. 60 p, 5 Fig, 5 Tab, 66 Ref, 1 Append. R805617.

Descriptors: *Utilities, *Economics, *Water supply, Electric power industry, *Water demand, Water distribution(Applied), Diseconomies of scale, Economic efficiency, Coordination, Planning.

One of the consequences of the Safe Drinking Water Act of 1974 has been an emphasis on the possible benefits of consolidating water suppliers into regional systems to offset some of the increased costs through scale economics and other gains in economic efficiency. Consolidation in the electric power supply industry is investigated as an example of a possible method for offsetting these new costs of water treatment. The structure of the power industry is examined along with the history, potential advantages, and costs and benefits of coordination. Alternatives to the present power system are also considered. The electric power industry has attained a high degree of interconnection and significant levels of coordination or consolidation on a regional basis, yet the extent of coordination and consolidation has not been as great as had earlier been predicted and advocated on grounds of economic efficiency. Evidence available indicates that few economic benefits have actually been realized from coordination. Some power systems or functions (distribution, for example) are larger than the optimum size. Only about 42% of the community water systems are privately owned, and they supply only 12% of the treated water in the United States. The greatest potential gains from consolidation may be among private systems and between publicly owned and private utilities. Alternative ways to capture the potential economies of regionalization may also be viable. These include pooling and coordination to the degree that the cost savings warrant, up to and including large systems under common ownership. (Moore-SRC)
W81-01680

DEVELOPMENT AND APPLICATION OF A WATER SUPPLY COST ANALYSIS SYSTEM; VOLUME I,
ACT Systems, Inc., Winter Park, FL.
J. I. Gillean, W. L. Britton, Jr., J. H. Brim, and R. M. Clark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-152183, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-012a, July, 1980. 80 p, 24 Fig, 2 Tab, 7 Ref, 2 Append. 68-03-2506.

Descriptors: *Cost analysis, *Utilities, *Water rates, *Data collections, Kentucky, Water costs, Water supply, Management, Water treatment, Water delivery, Operation and maintenance.

Although most utilities maintain an accounting system, the data provided by these systems are maintained in different formats and are therefore incompatible among utilities. Few systems provide continuous and adequate cost information directly. The Environmental Protection Agency initiated a research program to develop standardized techniques for analyzing costs witin a utility accounting framework. The system has been implemented successfully in Kenton County Water District No. 1 in Kentucky. Overall, the performance of the system has been impressive. In addition to providing useful management reports, the cost analysis system has assisted in improving the existing Kenton County Water District financial reporting system. The utility director has used the data to make key decisions regarding operations and for establishing billing rates to selected users, as well as for a general rate re-evaluation study. The system, using a matrix concept, can match operational and financial data at the top level functions of acquisition, treatment, delivery, and support services, and for two lower levels of detail. This system allows a water utility manager to evaluate the cost of the utility down to the smallest componet of the system. The costs are logically structured so one can move from one level to another with compatible data. The system can be used to estimate the cost of water as it flows through the actual utility system and is delivered to the various consumers. The reports generated by the system can be used to compare budgeted versus actual expenditures as well as a cost comparison between specific operations for different time periods. (Moore-SFR)
W81-01682

THE CONSTANT PERCENT RULE IN INTRA-SECTORAL WATER ALLOCATION,
Florida Univ., Gainesville. Dept. of Food and Resource Economics.
G. D. Lynne, and C. F. Kiker.
Economic Report 97, May, 1980. 16 p, 2 Fig, 1 Tab, 15 Ref.

Descriptors: *Florida, *Water allocation, *Cost allocation, Prices, *Water rates, Supply, Pricing, *Water distribution(Applied), Water allocation(Policy), Water demand, Economics, Water supply, Competing uses, Water consumption, Water policy, Commerical use.

Water management districts in Florida are charged with allocating water among competing users, including the commercial sector. Two water allocation rules are the 'constant percent rule' (CPR) and the 'economic efficiency rule' (EER). The study uses a 'best guess' total water demand curve relationship in addition to empirical estimates from an earlier study to show that CPR, which provides a uniform percentage reduction, does not provide equal benefit reductions. Under the EER rule, water is allocated among competing users during water-short periods to maximize economic efficiency. Total benefit losses from a required overall reduced use of 15% may be greater with the CPR, while implementing the EER through raising prices resulted in substantial reduction of benefit losses to three of the four groups considered—grocery stores, eating and drinking establishments, and hotels-motels, but not department stores. The hotel-motel group gained the most from the use of the EER in both a relative and an absolute sense. (Garrison-Omniplan)
W81-01739

ALBERTA ENVIRONMENT MINISTER FORESEES MANY CHALLENGES FOR PROVINCE IN THE '80'S.
For primary bibliographic entry see Field 6E.
W81-01851

DEVELOPING A COST-EFFECTIVE SLUDGE MANAGEMENT APPROACH,
Proctor-Davis-Ray, Inc., Lexington, KY.
For primary bibliographic entry see Field 5E.
W81-01888

6D. Water Demand

LAKE MICHIGAN WATER ALLOCATION IN ILLINOIS,
Illinois State Dept. of Transportation, Springfield. Div. of Water Resources.
F. L. Kudrna, D. R. Vonnahme, and K. L. Brewster.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 43-54, March, 1980. 1 Fig, 1 Tab, 5 Ref.

Descriptors: *Water allocation(Policy), *Water management(Applied), *Lake Michigan, Potential water supply, Water resources, Water conservation, Regulation, *Illinois, Equitable apportionment, Planning.

The process used by the Illinois water authorities to allocate Lake Michigan water to communities in northeastern Illinois to ensure that all communities will have adequate water for projected growth and development is described. Water allotment was developed from data collected in 1974 covering 6 counties and a population of 7,000,000 people. The principal factors considered were historical growth, new growth areas available through annexation, and land available for development within existing municipal boundaries. Per capita water consumption was also considered. Water demand for five steel mills was considered separately from municipal demand. Water resources available to the area were assessed, and the water allocation order was issued. A water conservation program is briefly described which includes placing brochures on water conservation in utility bills and providing schools with water conservation information. Systems management is also currently used to identify and properly use water resources. Continuous monitoring of water demand and use indicates that the allocation plan will meet Illinois' needs until 2010. (Small-FRC)
W81-01839

SLUDGE DEWATERING PLANT USES PROGRAMMABLE CONTROLLERS.
Public Works, Vol 111, No 2, p 82, February, 1980.

Descriptors: *Sludge, *Dewatering, *Centrifugation, Waste water treatment, Equipment, Sewage sludge, *Sludge treatment, Separation techniques, Control systems, *Los Angeles County, California.

The Los Angeles County's Carson sludge dewatering plant employs four huge centrifuges to meet new water quality standards. Each unit is fed wet sludge until a predetermined volume of dry solids is collected. A single programmable controller operates all four centrifuges, which saves on overall costs for the operation. When full the centrifuges are emptied with the inverters at low speed. When the centrifuges have decelerated to 50 rpm, a plow is introduced into the bowl of each to cut out the sludge cake which falls onto a conveyor a floor below. The cycle takes only about 20 minutes; however, more control problems are encountered than would occur in a continuous system. This is attributed to the static state of the system and the need for the controller to continuously monitor process conditions and initiate corrections. The controls are economical and flexible. They may be quickly programmed, and are not affected by dirt and wear, since they contain no moving parts. Numerous pilot studies were conducted with the control programs to make modifications and improvements before the equipment was installed. The efficiency and reliability of the process has enabled the programming to be routinely handled by plant engineers. (Geiger-FRC)
W81-01896

6E. Water Law and Institutions

AN INDUSTRY POINT OF VIEW,
British Columbia Packers, Ltd., Vancouver.
R. I. Nelson.
In: Pollution and the Fisheries: Proceedings, 27th Annual Meeting of the Fisheries Council of Canada, Environmental Protection Service, Report No EPS 3-WP-73-4, August 1973, p 28-35.

Descriptors: *Cost sharing, *Water pollution control, *Jurisdiction, *Industrial wastes, *Canada, Construction costs, Costs, Expenses, Legal aspects, Federal jurisdiction, Political aspects, Aquatic life, Water quality, Water quality control, Water quality standards, Water policy, Control, Pollution abatement, Industrial production, Cost analysis, Operating costs, Fisheries.

Adequate water quality is critical to fish survival. Certain pollutants, at levels below those affecting survival, can be concentrated in fish, making them unsuitable for eating. Thus, the fishing industry, although engaged in processing operations that produce wastes contributing to pollution, views pollution as a serious problem. Societal, political, and economic concerns exist. The recent 'scare' of mercury in certain fish species resulted in social concern for the quality of fish in general. Public presentation of balanced and realistic views provided by the government is needed. For pollution control, financial assistance should be provided. The Canadian Federal Government is spending more than one billion dollars for regional economic development programs, but the Department of the Environment has no funds for assistance to industry in controlling pollution problems. Without government assistance, the cost of pollution control systems by industry will cause sacrifice of modernization/expansion plans and failure of some businesses. Also, conflicts of jurisdiction occur for water uses: international, interprovincial or Federal-provincial. Examples have been noted. The International Joint Commission should assist resolution of Canadian-United States conflicts. (Zielinski-IPA)
W81-01707

STATE/EPA AGREEMENT, FY 81.
Washington State Dept. of Social and Health Services, Olympia.
September, 1980. 607 p, 10 Fig, 26 Tab, 18 Append.

Descriptors: *Washington, *Environmental engineering, Air environment, *Solid wastes, *Water quality standards, Waste disposal, Monitoring, Administration, Planning, Comprehensive planning, Natural resources.

Six environmental program issues plus an Executive Summary comprise the FY 81 agreement between the State of Washington and the U.S. Environmental Protection Agency. This document, which identifies commitments by each party to specific program priorities in FY 81, includes sections on Program Coordination, Water Quality Management, Solid and Hazardous Waste Management, the Washington State Drinking Water Program, Air Quality Management, and a Responsiveness Summary. Priority environmental problems listed include: Mt. St. Helens eruptions, which caused catastrophic local water system disruptions and continued air and water quality problems from ash fall; hazardous waste disposal, for which an acceptable site must be found and developed; energy facility sites, which must be identified and analyzed for environmental and socioeconomic impacts; municipal waste water, for which treatment plants must be upgraded; water quality problems in rivers, which include high bacterial counts, elevated temperatures, and high turbidity; air quality, in relation to areas in the state that have not achieved the national ambient air quality standards; and small public water systems, which have trouble maintaining water quality facilities. Program solutions are described for each of these priority problems, and methods for monitoring state and EPA commitments are defined. (Mantius-Omniplan)
W81-01743

ANALYSIS OF WATER RESOURCES PLANNING AND DECISION-MAKING PROCESSES AND OUTCOMES,
Policy Sciences Associates, Boulder, CO.
For primary bibliographic entry see Field 6A.
W81-01755

WATER POLLUTION CONTROL IN JAPAN,
Water Resources Development Public Corp., Tokyo (Japan).
T. Hayashi.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 850-861, May, 1980. 1 Fig, 3 Tab.

Descriptors: *Legislation, *Standards, Water conservation, Administration, Water quality, *Water pollution control, Government, Toxins, *Japan.

The history of water quality legislation and administration in Japan, including current conservation and effluent control measures, is reviewed. The Water Quality Conservation Law was enacted in 1958 as an attempt to systematize water pollution control and establish effluent standards. The Factory Effluents Control Law of 1959 set penalties for industrial contamination. Increased environmental problems resulted in the passing of the Basic Law for Environmental Pollution Control in 1967, which established basic guidelines for determing the scope of environmental pollution, the responsibilities of those concerned, and the methods and measures for control. The Water Pollution Control Law of 1970 and the Seto Inland Sea Conservation Law of 1973 were even more specific. Water control standards set by administrators of water pollution programs are presented in a table. Water quality in Japan has improved in recent years, reflecting the vigorous enforcement of stronger control measures. The percentage of water quality samples that met the environmental water quality standards for nine toxic substances increased to 99.6% in 1977. Recent amendments to laws are reviewed. (Small-FRC)
W81-01794

CONFLICT BETWEEN ENERGY CONSERVATION AND WATER POLLUTION CONTROL STANDARDS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. C. Lamb, III.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 656-660, April, 1980.

Descriptors: *Energy, *Conservation, *Regulation, Legislation, *Water pollution control, Pollution abatement, Environmental effects, Water quality standards.

Environmentalists have insisted on careful evaluation of the environmental impacts of energy resource development, but now must consider the energy impact of environmental actions. Present water pollution regulatory programs require the installation of some waste water treatment plants that serve no justifiable function. All municipalities are required to install secondary treatment facilities, whether those communities produce oxygen consuming wastes or not. Furthermore, plants are required to operate continuously with no regard to waste flow. Finally, if the plant fails to meet standards, the owner is fined and required to make costly changes even if no environmental damage has been done. Blanket standards are wasteful. The approach should be modified to permit logical, scientifically correct, and environmentally necessary flexibility in administering pollution control standards. Goals can be accomplished without systematic waste. (Small-FRC)
W81-01821

POLICY ISSUES CONCERNING WATER QUALITY/QUANTITY,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 71-79, March, 1980. 5 Ref.

Descriptors: *Water policy, *Cost-benefit analysis, Project planning, Governmental interrelation, Water quality standards, Water law, U.S. Water Resources Council, *Water management.

A coordinated approach of total water management is presented as a method which can achieve national water quality goals more efficiently than the Principles and Standards of the Water Resources Council. Lack of coordination between EPA, HUD, the Soil Conservation Service, and the Corps of Engineers, including differences in feasibility criteria and cost-sharing arrangements, results in a lack of effective water quality management. Policy alternatives to integrate water quantity and water quality planning are discussed. The most workable alternative is to decide on desired water quality goals and then apply cost-effectiveness criteria to all pollution sources, point and

nonpoint. Using this approach, it would not be necessary to determine economic benefits of water quality improvements, but only to determine which of the available approaches would reach the desired environmental goal at the lowest cost. (Small-FRC)
W81-01835

ALBERTA ENVIRONMENT MINISTER FORESEES MANY CHALLENGES FOR PROVINCE IN THE '80'S.
Water and Pollution Control, Vol 118, No 12, p 20-21, December, 1980.

Descriptors: *Alberta, *Water supply, *Sewage treatment, *Grants, *Financing, Waste water treatment, Calgary, Edmonton, Public utilities, Phosphorus compounds, Municipal water, Government finance, Water policy, Costs.

John W. Cookson, Alberta Minister of the Environment, described the functions of the Alberta Municipal Water Supply and Sewage Treatment Grant Program during the keynote address at the Western Canada Water and Sewage Annual Conference. Municipalities of all sizes are eligible for aid to either upgrade or replace present facilities or install new plants. The Edmonton Regional Utilities Study examined solutions to water supply and sewage disposal problems within the 13,800 square kilometer area surrounding the city, which is the site of current high population growth. Calgary's modern waste water treatment plant was mentioned as an example of pollution problems. A phosphorus removal grant program (total $18.1 million over 6 years) was established to help all communities install phosphorus removal facilities. The city will pay the first $20 per capita, and then receive 90% of capital costs from the Province. (Cassar-FRC)
W81-01851

7. RESOURCES DATA

7B. Data Acquisition

WATER LEVEL RECORDER,
Systron-Donner Corp., Concord, CA. (Assignee).
J. D. Gearheart, and F. W. Jenkinson.
U.S. Patent No 4,200,876, 7 p, 7 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1849, April 29, 1980.

Descriptors: *Patents, *Water level recorders, Instrumentation, Water levels, Water level fluctuations, Data transmission, Monitoring.

A water level recorder for use with pressure-sensitive chart paper has a framework with a lead screw rotatably mounted in the framework. A pulley is secured to the lead screw. The pulley is driven by a tape which is positioned by a float that is adapted to rest upon the surface of the water. A lead screw nut is mounted on the lead screw for movement longitudinally of the lead screw as it is rotated. A marking member is carried by the lead screw nut. A drum is secured to the lead screw for rotation with the lead screw. A helix for marking the chart paper is formed on the drum. Chart paper drive means are provided for advancing the chart paper over the helix and the marking member. Platen assemblies movable into and out of engagement with the chart paper are adapted to engage the chart paper to retain it so that two traces are formed on the chart paper as it is advanced, one by the marking member and one by the helix to give coarse and vernier indications respectively of the water level being measured. (Sinha-OEIS)
W81-01719

SATELLITES AS AID TO WATER RESOURCE MANAGERS,
National Environmental Satellite Service, Washington, DC.
D. F. McGinnis, Jr., R. A. Scofield, S. R. Schneider, and C. P. Berg.
Journal of the Water Resources Planning and Mangement Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 1-19, March, 1980. 14 Fig, 1 Tab, 14 Ref.

Descriptors: *Satellites(Artificial), *Data collections, *Water management, Water resources development, Monitoring, Snow managment, Ice jams, Ice breakup, Flood forecasting, Precipitation intensity, Remote sensing.

The application of satellite-gathered environmental data to certain water resource planning problems is considered. Data useful to the water resource management field that can be obtained via satellite pictures include area of snow cover, river ice breakup, flood extent maps, and precipitation estimates from convective systems. The National Oceanic and Atmospheric Administration (NOAA) currently operates the NOAA polar-orbiting system of satellites and the GOES system of geostationary satellites. The systems possess 1 km resolution visible sensors which are sufficient for monitoring various mesoscale and macroscale water resources. Snow surveillance was done by satellite on 30 river basins in the United States and Canada during the winter of 1977-78. Satellite pictures may also serve as daily monitoring systems to provide early warnings of ice jams along rivers. Convective rainfall is calculated by comparing the changes in two consecutive pictures, both IR and high-resolution visible. Some rainfall images as portrayed by satellite for parts of Missouri are given, along with satellite pictures of Hurricane Anita over Texas in September 1977. (Geiger-FRC)
W81-01840

A SIMPLE AND INEXPENSIVE 4-PI LIGHT COLLECTOR AND TWO DESIGNS FOR A LIGHT METER FOR LIGHT ATTENUATION STUDIES,
Southampton Univ. (England). Dept. of Oceanography.
P. J. leB. Williams, and N. W. Jenkinson.
Freshwater Biology, Vol 10, No 6, p 491-496, December, 1980. 4 Fig, 1 Plate, 8 Ref.

Descriptors: *Instrumentation, *Light penetration, Aquatic productivity, Phytoplankton, On-site tests, Water bodies, Light intensity, *Selenium photocells.

A simple, inexpensive device for measuring light attenuation in the field was constructed, using whole table tennis balls as the 4-pi spherical light collector. Two designs for simple meters to be used with selenium photocells are given--one based on an operational amplifier powered by two 9-volt dry cells and one a direct-reading log-ratio meter. The detector operates successfully down to a depth of 10 meters, and may be modified for deeper water use by filling the balls and detector head with a transparent oil. (Cassar-FRC)
W81-01873

7C. Evaluation, Processing and Publication

WATER RESOURCES OF THE COOK INLET BASIN, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
G. W. Freethey, and D. R. Scully.
Available from the Br. of Dist., USGS Box 25286, Fed. Ctr. Denver, CO 80225, Price: $6.00. Geological Survey Hydrologic Investigations Atlas HA-620, 1980. 14 Fig, 5 Tab, 33 Ref, 4 Sheets.

Descriptors: *Water resources, *Groundwater, *Surface-groundwater relationships, *Hydrogeology, *Alaska, Groundwater potential, Stratigraphy, Aquifers, Aquifer characteristics, Water yield, Geomorphology, Water resources development, Streamflow, Flow rates, Discharge(Water), Runoff, Regression analysis, Hydrologic data, *Cook Inlet(AK).

Ground-water and surface-water systems of Cook Inlet basin, Alaska, are analyzed. Geologic and topographic features that control the movement and regional availability of ground water are explained and illustrated. Five aquifer systems beneath the most populous areas are described. Estimates of ground-water yield were determined for the region by using ground-water data for the populated areas and by extrapolating known subsurface conditions and interpreting subsurface conditions from surficial features in the other areas. Area maps of generalized geology, Quaternary sediment thickness, and general availability of ground water are shown. Surface-water resources are summarized by describing how basin characteristics affect the discharge in streams. Seasonal trend of streamflow for three types of streams is described. Regression equations for 4 streamflow characteristics (annual, monthly minimum, and maximum discharge) were obtained by using gaging station streamflow characteristics and 10 basin characteristics. In the 24 regression equations presented, drainage area is the most significant basin characteristic, but 5 others are used. Maps of mean annual unit runoff and minimum unit yield for 7 consecutive days with a recurrence interval of 10 years are shown. Historic discharge data at gaging stations is tabulated and representative low-flow and flood-flow frequency curves are shown. (USGS)
W81-01671

COLUMBIA GLACIER, ALASKA: RECENT ICE LOSS AND ITS RELATIONSHIP TO SEASONAL TERMINAL EMBAYMENTS, THINNING, AND GLACIAL FLOW,
Geological Survey, Tacoma, WA. Water Resources Div.
W. G. Sikonia, and A. Post.
Available from the Br. of Dist., USGS Box 25286, Fed. Ctr. Denver, CO 80225, Price: $3.75. Geological Survey Hydrologic Investigations Atlas HA-619, 1980. 3 Sheets, 16 Fig, 13 Ref.

Descriptors: *Glaciers, *Hydrography, *Mapping, *Ablation, *Alaska, Bays, Ice, Icebergs, Calving, Movement, Ice-water interfaces, Discharge(Water), Aerial photography, Photogrammetry, Surveys, Hydrographs, Hydrologic data, *Columbia Glacier(AK), Glacier flow.

In 1974 the U.S. Geological Survey began an intensive investigation of the stability of Columbia Glacier, a calving tidewater galcier terminating in Columbia Bay, near Valdez, Alaska. Aerial photographs taken in 1957 and a sequence of photographs taken at about 2-month intervals since 1976, when analyzed photogrammetrically, provided detailed data on changes in Columbia Glacier's thickness, flow rate, and terminal position. Annual embayments in the glacier's terminus form during the summer-autumn season in most years; the size of embayments appears to be related to (1) the thickness of the glacier, and (2) the position and nature of subglacial freshwater discharge. Embayments have apparently increased in size in recent years; the largest embayments yet observed formed in 1975, 1976, 1977, and 1978. From April 1, 1977, to April 1, 1978, the total volume of ice calved was about 1.0 cubic kilometer. By January 1979 the glacier front had retreated from Heather Island. Glacier flow varies seasonally and synchronously in the lower 17 kilometers of the glacier; large accelerations occur near the terminus in response to embayment formation. Daily speed within 5 kilometers of the terminus increased from about 1.9 meters per day between 1963 and 1968 to about 2.7 meters per day between 1977 and 1978. In the lowest 15 kilometers, the glacier surface was lowered about 9 meters between 1957 and 1974, and about 13 meters between 1974 and 1978. Columbia Glacier is being reduced in mass due, in part, to recent losses caused by large embayments forming annually. If such reduction continues it will result in a drastic retreat. (USGS)
W81-01672

SUMMARY OF WATER-LEVEL AND DISCHARGE RECORDS FOR THE EAST EVERGLADES AREA, DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. J. Schneider.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $5.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File

Report 80-215, 1980. 33 p, 4 Fig.

Descriptors: *Data collections, *Surface waters, *Groundwater, *Florida, Sites, Water levels, Discharge(Water), Data storage and retrieval, *Dade County(FL), East Everglades area(FL).

Information concerning data collected and records maintained for 25 surface-water and 10 groundwater sites in the East Everglades area, Dade County, Fla., is presented. Listed are: location of sites, period of record, type of gage used, average discharge, and extremes for period of record. A history of records for each site includes the format of the data published and what data are stored in the U.S. Geological Survey computerized data system. (USGS)
W81-01673

WATER RESOURCES DATA FOR ALASKA, WATER YEAR 1979.
Geological Survey, Anchorage, AK. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-144818, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report AK-79-1, November, 1980. 365 p, 4 Fig.

Descriptors: *Alaska, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for Alaska consist of records of stage, discharge, and water quality of streams; stage and water quality of lakes; and water levels and water quality in wells and springs. This report contains discharge records for 111 gaging stations, stage only records for 2 gaging stations, water quality for 58 stations, and water levels for 30 observation wells. Also included are 62 low-flow, 89 crest-stage, and 24 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements of discharge, lake stage, or water quality. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alaska. (USGS)
W81-01677

WATER RESOURCES DATA FOR ARKANSAS, WATER YEAR 1979.
Geological Survey, Little Rock, AR. Water Resources Div.
Geological Survey Water-Data Report AR-79-1, October, 1980. 633 p, 5 Fig, 3 Tab.

Descriptors: *Arkansas, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for Arkansas consist of records of stage, discharge, and water quality of streams and wells; stage, contents, and water quality of lakes and reservoirs. This report contains discharge records for 66 gaging stations; stage only records for 1 gaging station; stage and contents for 4 lakes and reservoirs; water quality for 151 stations, 51 partial-record flow stations, 7 lakes, and 5 wells; and water levels for 83 observation wells. Also included are 125 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Arkansas. (USGS)
W81-01678

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1979--VOLUME 4. NORTHWEST FLORIDA.
Geological Survey, Tallahassee, FL. Water Resources Div.
Geological Survey Water-Data Report FL-79-4, September, 1980. 686 p, 48 Fig, 1 Tab, 9 Ref.

Descriptors: *Florida, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Northwest Florida.

Water resources data for the 1979 water year in northwest Florida consist of continuous or daily discharge for 69 streams, periodic discharge for 28 streams, peak discharge for 23 streams and continuous or daily stage for 4 streams; continuous elevations for 4 lakes and periodic elevations for 30 lakes; continuous ground water levels for 41 wells and periodic ground water levels for 353 wells; quality of water for 37 surface water sites and for 95 wells. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (USGS)
W81-01679

A CASE STUDY OF COMPUTERIZED INDUSTRIAL WASTE DATA,
Metropolitan District Commission, Boston, MA. Sewerage Div.
N. D. Baratta, G. H. Bollier, and P. E. Schafer.
Public Works, Vol 111, No 9, p 105-107, September, 1980. 1 Fig.

Descriptors: *Data storage and retrieval, *Industrial wastes, Data processing, Computer programs, Waste treatment, Treatment, Standards, Management, Boston(MA).

A computerized data management system has been developed for the Metropolitan District Commission Sewerage Division, Boston, Massachusetts. This program may be used to prepare reports as required by EPA or other agencies, for example, summaries of toxic substances discharged, industry listings, and spill detection lists. The computer program may be applied to many requirements for industrial waste pretreatment as listed in CFR 40, Part 403. Report options on industries may be in several forms: alphabetical by category, log number, SIC number, pretreatment construction status, municipal summary sheet, constituent code, mass emission (pollutants), and permit renewal. Future options include lists of industries by flow rate, disposal method, type of pretreatment, and violations. (Cassar-FRC)
W81-01887

8. ENGINEERING WORKS

8A. Structures

SEWER CONSTRUCTION BY SHIELD METHOD IN YOKOHAMA,
Sewage Works Bureau, Yokohama (Japan).
S. Miyakoshi.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 923-930, May, 1980. 8 Fig, 1 Tab.

Descriptors: *Sewers, *Construction, *Soil strength, Structural engineering, Earthworks, Design, Soil density, Performance, Shield method, Japan, *Yokohama(Japan).

The shield method of sewer construction was used in Yokohama (Japan) to construct sewers in damp, soft soil. A recent development is the controlled soil pressure shield, in which excavated soil is used to stabilize the face when adjusting the volume of discharged soil. A mud-slurry pressure shield has also been developed, in which the pressure of the mud slurry stabilizes the face while adjusting the volume of fed and discharged slurry. Examples are given of sewer construction in soft ground, the blind shield method, the mud slurry pressure shield method, controlled soil pressure shield method, and the shield method in a sandy layer with confined water. Shields which have been recently developed or improved are tail void filling, peat, gravel layer, and small diameter shields. In Yokohama, there are presently eight waste water treatment plants in operation and three more under construction, and the total length of sewers is 3160 km spread through hills and soft soil near the river. (Small-FRC)
W81-01766

UNIQUE DESIGN FEATURES OF KOBE'S WASTE WATER TREATMENT PLANT,
Japan Sewage Works Bureau, Kobe.
K. Nakai.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 955-960, May, 1980. 2 Fig, 1 Tab.

Descriptors: *Treatment facilities, *Costs, *Recreation facilities, Swimming pools, Activated sludge, *Waste water treatment, Odor, Activated carbon, Cities, Japan, *Kobe area(Japan).

The unique design features of the Tarumi waste water treatment plant and community center, the latest plant to be constructed in the densely inhabited (13,255 people/ha) Kobe area (Japan), are described. The plant servs 144,000 people and has a waste water volume of 54,720 cu m/day. The final effluent is discharged into the Seto Inland Sea after conventional activated sludge processing and dewatering. Dewatered cakes are disposed of at a landfill. The waste water treatment center is built beneath several swimming pools, tennis courts, a playground, and a parking lot. Offensive odors are carefully controlled at the plant, since it functions as a community center. Synthesized adhesive carbon absorption, active carbon absorption and ozone masking are used for odor control. Since its establishment five years ago, the center is used by about 1000 people a day. About 1000 swimmers a day use the pools, although there is an admission charge. The facility cost 195 million yen (210 yen = 1 US dollar in 1978) for the land, 5589 million yen for the treatment plant, 387 million yen for the Community Center, and 367 million yen for the various other facilities. (Small-FRC)
W81-01795

DESIGN OF MULTISTORY SETTLING TANKS IN OSAKA,
Japan Sewage Works Bureau, Osaka.
K. Matsunaga.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 950-954, May, 1980. 5 Fig, 1 Tab.

Descriptors: *Settling tanks, *Construction, *Design, Pipes, Weirs, Aeration, *Engineering structures, Land use, Multistory structures, Japan, *Osaka(Japan).

The construction of settling tanks two or three stories high or the installation of an aeration tank on top of a final settling tank have been planned for the efficient utilization of limited available land in Osaka, Japan. Special equipment is necessary for such facilities, including aeration equipment in the inflow conduit, perforated pipes or overflow weirs for outlet equipment, telescopic outlet pipes, and assembled-type outlet pipes. Sludge collectors tend to have chain wear on one side as the result of looseness or twisting, so the tension of the chain must be monitored. Aeration tanks are available that are assembled on final settling tanks, and assembled-type outlet pipes are necessary. Tests at a two story treatment plant demonstrated that effluent can successfully be withdrawn over triangular notch-type weirs for the upper tanks and through telescopic-type outlet pipes for the lower tanks. Assembled-type outlet pipes are used at the three-story Tsumori Sewage Treatment Plant to equalize inflow rate. (Small-FRC)
W81-01797

AGING URBAN WATER SYSTEMS: A COMPUTERIZED CASE STUDY,
Betz, Converse, Murdoch Inc., Plymouth Meeting, PA.
D. K. O'Day, C. M. Fox, and G. M. Huguet.

Public Works, Vol 111, No 8, p 61-64, 111, August, 1980. 2 Fig, 3 Tab.

Descriptors: *Water distribution(Applied), *Lateral conveyance structures, *Aging(Physical), Data processing, Evaluation, Leakage, Durability, *New York, Public utilities, Water conveyance, Surveys, Performance, Urban areas, Conduits, Pipelines, Deterioration, Surveys.

An engineering and computer analysis of the New York City water distribution system was performed to study the relationship between water main breaks and the structural integrity of the water mains. The study evaluated the causes of all main breaks, identified any discernable patterns or trends in breaks, and recommended measures to alleviate water main break problems. The methodology developed for this study can assist water system managers in making sound decisions about pipe replacement during the course of roadway reconstruction or utility work. Also, the methodology can be used to plan five or ten years ahead. The study found that New York's system is not wearing out because of age and there is no evidence that the cast iron pipes are deteriorating. Small diameter mains had the highest breakage rate due to bedding problems. These bedding problems are often caused by leaks. Location seemed to be the single most important factor in breakage; a 19th century system cannot meet 20th century stress. (Small-FRC)
W81-01877

TREATMENT STRUCTURE SUPPORT OVER DIFFICULT SOILS,
Associated Pile and Fitting Corp., Clifton, NJ.
H. W. Hunt.
Public Works, Vol 111, No 9, p 131-134, September, 1980. 5 Fig.

Descriptors: *Soil engineering, *Water storage, *Piles(Foundation), Waste storage, *Engineering structures, Concrete piles, Timber piles, Construction materials, Design criteria.

Support structures over difficult soils are considered. Structures must be free of settlement if they are to be used for waste water handling to prevent contaminants from seeping out of cracks or causing additional damage to the initial structure. Design limitations should require no more than 1/2 inch differential settlement between tanks or structures. Good design requires dependable borings to provide subsurface information and to enable the builder to gain adequate and current information. Various types of piles are considered, including the non-displacement H-pile, precast concrete piles, composite piles, and timber piles. In planning the construction at least one boring should be made for each 2,500 square feet of space. Standard sampling spoon procedures should be used and blows recorded. All information concerning subsurface conditions must be made available to prospective bidders. (Baker-FRC)
W81-01880

PROBLEMS OF CORROSION CONTROL IN WATER DISTRIBUTION SYSTEMS,
L. M. Applegate.
Public Works, Vol 111, No 7, p 54-57, July, 1980. 3 Fig.

Descriptors: *Corrosion control, *Cathodic protection, Water distribution(Applied), Water delivery, Coating, Pitting(Corrosion), Pipes, *Pipelines, *Water conveyance, California, *Oroville(CA).

Corrosion control problems encountered in the water system of Thermalito Irrigation District in Oroville, California, are described. The district is served by a small reservoir, a good well and a filtration plant. A 20-inch main with lateral branches extends a few miles from the filtration plant, and here occasionally leaks have occurred. A cathodic protection system has been installed to protect against such leaks. Cathodic protection for the system was established in two parts. A 2 million gallon flat bottomed water tank at the filtration plant was the site of the first cathodic protection. Second, a 50-volt, 50-ampere rectifier and a large anode bed in a heavy gravel-soil pasture east of the tank were built. The soil resistivity there was typical of good agricultural soils, 2500 ohm-cm. Use of small multiple rectifiers and small anode beds, characteristic of gas line protection, are recommended for use in water systems, as they would tend to equalize the potentials on adjacent water and gas lines. Interference would be lowered and could be eliminated. (Baker-FRC)
W81-01883

THE TRINIDAD WATER PROJECTS,
CH2M/Hill International, Corvallis, OR.
L. A. Dove.
Public Works, Vol 111, No 7, p 69-72, July, 1980. 5 Fig.

Descriptors: *Construction, *Water supply development, Design standards, Design, Water supply, Water demand, Water delivery, Water yield improvement, *Trinidad.

The development of a US$250 million water supply and transmission system for the island of Trinidad is reviewed. The first phase involved design and construction of the Navet dam, reservoir, and pumping station, and expansion of the treatment plant serving critical areas in central and south Trinidad. The system's capacity was increased from 14 mgd to 23 mgd. The second phase is the Caroni-Arena Project, a 100 ft high seasonal storage dam, a 72 mgd Caroni water treatment plant, and a water transmission system to serve areas west of Port-of-Spain and southwest to San Fernando. The third phase is the Interim Water Supply Project, which is currently relieving water problems in north Trinidad in the short-term. In a period of 10 years the Republic of Trinidad and Tobago will have tripled its available water supply and will continue to grow to serve increasing numbers of customers with good quality water. (Baker-FRC)
W81-01892

8B. Hydraulics

IMPROVED IMPLICIT PROCEDURE FOR MULTICHANNEL SURGE COMPUTATIONS,
Hydro and Power Authority, Vancouver (British Columbia).
K-H. Kao.
Canadian Journal of Civil Engineering, Vol 7, No 3, p 502-512, September, 1980. 18 Fig, 4 Tab, 4 Ref.

Descriptors: *Model studies, *Tailrace, *Open channel flow, Mathematical models, Channels, Equations, Computer programs, British Columbia, Peace River, Finite element analysis, Surges.

When the explicit finite difference technique is applied to solve the equations for unsteady open channel flows, the duration of each time step is restricted by the Courant condition. Often the time step becomes too small for efficient computation. To overcome this problem, a method of numbering the computation points along a system of waterways is proposed. When the system is composed of many channels and each branch watercourse is assumed to be one-dimensional, the proposed numbering technique will generate a narrow diagonally banded coefficient matrix of simultaneous equations. An IBM computer program (GELB) may be used to solve the system of simultaneous equations. This yields a significant decrease in computing time as well as a reduction in computer storage requirements. The procedure was applied to the Y-shaped channel of the tailrace system of Portage Mountain Development on the Peace River in British Columbia. Computed and hydraulic model tests results for this system showed close agreement. (Geiger-FRC)
W81-01779

8C. Hydraulic Machinery

WINTER ICE REMOVAL FROM STOCK WATER PONDS,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
J. E. Garton, T. Ghermazien, and K. Robinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-167207, Price codes: A03 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University Project Completion Report, September, 1980. 34 p, 18 Fig, 6 Tab. OWRT-A-086-OKLA(1), 14-34-0001-9038.

Descriptors: *Ice-water interfaces, *Melting, *Cattle, *Stock water, *Hydraulic equipment, Water circulation, *Farm ponds, Potable water, Ice, Ice cover, Climatology, Freezing, Ice breakup, Water sources, Domestic animals, Livestock, Ruminants, Trawling, Motor generators, Pumps, Pump testing, Turnovers, Pumping, Thermal stratification, Bodies of water, Ponds, Water holes.

The purpose of this study was to find a practical, reliable, and inexpensive method for melting ice on farm ponds during the winter to allow livestock accessibility to water. An alternative means of removing ice from the near-shore surface of ponds was found, rather than requiring that farmers/ranchers routinely chip holes in the ice. The performances of two methods were tested: (1) use of an electrically-operated submersible pump; and (2) a wind-electric generator directly connected to an electric trolling motor, to stimulate conditions in remote locations lacking electricity. By either technique, warmer water from greater depths was circulated to the surface of the pond. A water jet was directed upward at a 45 degree angle towards the shore in each of three ponds studied. It was concluded that, with electricity available, submersible pumps would be more economical than use of an electric trolling motor, trickle charger and battery, due to equipment and maintenance costs of the latter system. For remote ponds with no available electricity, the wind-electric plant can be directly connected to the trolling motor; refreezing of the hole on calm days resulted in only relatively thin ice cover that could be broken by cattle. (Zielinski-IPA)
W81-01651

AN INEXPENSIVE INSTRUMENT FOR MEASURING SOIL WATER TABLE LEVELS,
Department of Agriculture, Saint-Jean (Quebec). Research Station.
J. A. Campbell, J. A. Millette, and M. Roy.
Canadian Journal of Soil Science, Vol 60, No 3, p 575-577, August, 1980. 2 Fig, 1 Tab, 1 Ref.

Descriptors: *Water table, *Water level recorders, Instrumentation, Water measurement, Soil water, On-site tests, Metal pipes, Hydraulic structure, Plastic pipes, Potentiometers, Observation wells.

A simple and inexpensive instrument for measuring soil water table levels is described. The apparatus is an improvement upon previous implements because it overcomes the problem of metal contamination of water samples from the use of metal wells. The new instrument, which may be used with metal or plastic wells, features a probe which is inserted into a well, and a meter box. The probe is made of CPVC pipe with a vinyl tape epoxied to the outside of it. A two-conductor instrument cable bifurcates to form two electrodes which are soldered to prevent corrosion from acid soil water. A two-connector phono plug is connected to the other end of the cable. The meter components are diagrammed, and calibration procedures for the instrument are given. Accuracies of the measurements are within + or - 1 mm, and field and greenhouse tests with the new device have given very reliable results. (Geiger-FRC)
W81-01780

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SELECTED WATER RESOURCES ABSTRACTS

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W81-01901 -- W81-02150

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Office of Water Research and Technology. The cumlative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

AN ASSESSMENT OF STORM SURGE MODELING.
Water Resources Council, Washington, DC.
For primary bibliographic entry see Field 2L.
W81-01935

2B. Precipitation

KINEMATIC DESIGN STORMS INCORPORATING SPATIAL AND TIME AVERAGING,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
W. James, and J. J. Drake.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173858, Price codes: A11 in paper copy, A01 in microfiche.
In: Proceedings, Stormwater Management Model (SWMM) Users Group Meeting, 19-20 June, 1980, Toronto, Ontario, Environmental Protection Agency EPA 600/9-80-064, December, 1980, p 133-149. 7 Fig, 1 Tab, 19 Ref.

Descriptors: *Design storms, *Rainfall-runoff relationships, *Model studies, Storm runoff, Urban runoff, Storm water, *Water pollution, Hydrographs, Distribution patterns, Rainfall intensity.

Traditionally, design storms have been developed from statistical analysis of point rainfall records that include all types of rainstorms. The resultant rain distributions are unlike any type of observed rain storm. This synthetic temporal distribution is typically applied uniformly across the catchment and flow hydrographs are also unlike observed runoff hydrographs. The storm model presented in this study is based on the synoptic observations of rain cells reported in weather radar literature. The model generates hydrographs for each subcatchment, thus simulating the spatial and temporal growth and decay of a system of storm cells as they move across an urban catchment system. Intensity-duration-frequency curves obtained from the model are similar to those derived statistically from the long-term rainfall record. The model is applied to catchments in the Hamilton area in South Ontario, Canada. Results indicate that storm cell kinematics are significant, particularly in peak runoff estimates for drainage design and water pollutant loading estimates, because of the sensitivity of the time to peak and rate of rise of hydrographs and pollutographs. Such storm models appear to be useful for computer based rainfall-runoff studies. (Moore-SRC)
W81-01928

SPATIAL AND SEASONAL PRECIPITATION DISTRIBUTION IN SOUTHWEST IDAHO,
Science and Education Administration, Boise, ID.
C. L. Hanson, R. P. Morris, R. L. Engleman, D. L. Coon, and C. W. Johnson.
Science and Education Administration, Oakland, California, Agricultural Reviews and Manuals ARM-W-13, April, 1980. 15 p, 7 Fig, 5 Tab, 12 Ref.

Descriptors: *Idaho, *Precipitation(Atmospheric), *Distribution patterns, *Elevation, Spatial distribution, Temporal distribution, Seasonal, Storms, Mountains, Precipitation gages, Time, Hydrology, Watersheds(Basins).

Analysis of the 16 year record from the precipitation gage network on the Reynolds Creek Experimental Watershed in southwest Idaho shows that the average annual precipitation ranged from 250 mm on the low elevation (1100 m) areas of the watershed to 1100 mm on the high elevation (2160 m) areas. There was a linear relationship between summer (May through October) precipitation and elevation and winter (November through April) precipitation and elevation. July and August storm durations averaged about 3.6 hr at both the low and high elevations. December and January storms averaged 5.2 hr duration at the low elevations and 8.6 hr at the high elevations. The average interval between storms during July and August was 7.7 days at the low elevation site and 6.6 days at the high elevation site. The average interval between storms during December and January was 2.9 days at the low elevations and 1.7 days at the high elevations. At all elevations, the interval between storms was longer for the two summer months than for the two winter months. The 2-yr 6-hr precipitation at the low elevations was 20 mm. The 2-yr 6-hr precipitation at the high elevations was about 40 mm. These analyses show precipitation characteristics of a mountainous area from a dense precipitation gage network and provide data for hydrologic modeling and resource inventory evaluation. (Moore-SRC)
W81-01938

MODEL OF TIME AND SPACE DISTRIBUTION OF RAINFALL IN ARIZONA AND NEW MEXICO,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
H. B. Osborn, E. D. Shirley, D. R. Davis, and R. B. Koehler.
Science and Education Administration, Oakland, California, Agricultural Reviews and Manuals ARM-W-14, May, 1980. 31 p, 14 Fig, 6 Tab, 10 Ref, 1 Append.

Descriptors: *Rainfall disposition, *New Mexico, *Arizona, *Model studies, *Simulated rainfall, Watersheds(Basins), Hydrology, Range management, Rain gages, Depth-area-duration analysis, Distribution patterns, Runoff forecasting, Time, Isohyets, Mapping.

Rainfall data from two dense rain gage networks, several small groups of rain gages, and National Weather Service rain gages are used to describe the occurrence and depth-area distribution of rainfall and to develop a rainfall simulation program (model) for Arizona and New Mexico. Depth-area rainfall distribution is described by an assumed cellular thunderstorm structure, with verification limited to comparison of simulated and actual total rainfall patterns. Simulated rainfall is convenient to use in hydrologic models when long term rainfall records are unavailable. If point records are available, they can be used to verify the model. The program output includes accumulated seasonal rainfall for any designated point (gage), point totals for individual events for isohyetal mapping, starting and ending times for all events, and Thiessen weighted watershed averages. The output can be used directly to estimate peaks and volumes of runoff for very small watersheds (up to 100 hectares), and indirectly for larger watersheds with appropriate routing methods. Since the rainfall is distributed both in time and space, simulations of several years of record could be used to provide probabilities of wet and dry sequences to evaluate the chances of success for range renovation programs and could aid ranchers in overall planning of range management programs. (Author's abstract)
W81-01939

THE DISTRIBUTION OF KINETIC ENERGY OF RAINFALL IN SOUTH AFRICA - A FIRST ASSESSMENT,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Agricultural Engineering.
R. E. Schulze.
Water SA, Vol 6, No 2, p 49-58, April, 1980. 6 Fig, 1 Tab, 18 Ref.

Descriptors: *Erosion, *Rain, *Kinetics, Energy, Africa, Weathering, Impact(Rainfall), Precipitation(Atmospheric), South Africa.

Rainfall kinetic energies were derived from records of rainfall intensity measured at 14 stations located in a variety of rainfall regions in South Africa. The generalized relationship between kinetic energy (E) and rainfall intensity (I) is established at the monthly level of data using the Soil Loss Estimation Model for Southern Africa (SLEMSA) equation for E, and from these, mean annual, summer and winter distributions of E are mapped for the republic. In order to relate studies of soil erosion to rainfall, the intensity, size distribution, fall velocity and angle of impact of the raindrops must be known. The rainfall intensity is comparatively easily measured, and relationships between the energy and the intensity have been sought. Studies are currently being conducted on physically based soil loss models. As information is generally lacking concerning the magnitudes and patterns of rainfall energy in South Africa, efforts are underway to determine regional rainfall energy equations and map distributions of E. (Baker-FRC)
W81-01957

A DEPTH-AREA-DURATION MODEL OF STORM RAINFALL IN THE SOUTHERN GREAT PLAINS,
Science and Education Adminstration, Chickasha, OK.
A. D. Nicks, and F. A. Igo.
Water Resources Research, Vol 16, No 5, p 939-945, October, 1980. 8 Fig, 14 Ref.

Descriptors: *Depth-area-duration analysis, Storms, *Runoff forecasting, *Rainstorms, Hyetographs, Depth-area curves, Mathematical models, Least squares method, Great Plains, *Oklahoma, Rainfall-runoff relationships.

A depth-area-duration model for Oklahoma rainstorms was developed using 10 years of data from a dense network of recording rain gages spaced on a 5 by 5 km grid. The model relates mean depth of rainfall over a given area to storm center rainfall depth. Nonlinear least squares optimization was used to fit the data from 138 storms to the model. The model was tested using storm isohyetal maps available from published storm reports. In one case, the model simulation of the depth-area curve underestimated the actual depth by 23% at 777 sq km. This result was within the error found from network data tested with the model: mean errors ranged from 8% on 130 sq km to 27% on 3100 sq km. The model can be used to convert storm center point rainfall amounts to mean rainfall in areas up to 3100 sq km. The model seems to have predictive value, especially for storms which occur in the Great Plains area. (Small-FRC)
W81-01964

2C. Snow, Ice, and Frost

A MODEL FOR THE PREDICTION OF ICE LENSING AND FROST HEAVE IN SOILS,
Alberta Univ., Edmonton. Dept. of Mechanical Engineering.
R. R. Gilpin.
Water Resources Research, Vol 16, No 5, p 918-930, October, 1980. 11 Fig, 18 Ref.

Descriptors: *Frost heaving, *Physical models, Ice, *Soil properties, *Ice lenses, Thermal conductivity, Hydraulic properties, Water properties, Model studies.

A physical model based on the freezing of a saturated matrix of uniform spheres exhibited many of the characteristics observed in the frost heave of soils. If the radius of the spheres is equal to the radius of the finest 10% of the soil, the magnitudes of the heave rates are similar. Four factors were found to control heave rate: (1) the rate of heat conduction away from the freezing front, (2) the hydraulic resistance in the frozen fringe, (3) the hydraulic resistance at the ice lens, and (4) the hydraulic resistance in the unfrozen soil. The model predicts ice lensing and heave rates as functions of basic soil properties, and the results are in general agreement with experimental observations. The model does not account for changes in consolidation of the soil that may occur as a result in changes in pore ice pressure. In the model, the soil particles are assumed to form a rigid skeleton which breaks only when the ice pressure exceeds some specific pressure. (Small-FRC)
W81-01965

2E. Streamflow and Runoff

CONSIDERATIONS REGARDING THE APPLICATION OF SCS TR-55 PROCEDURES FOR RUNOFF COMPUTATIONS,
Ottawa Univ. (Ontario). Dept. of Civil Engineering.
P. Wisner, S. Gupta, and A. Kassem.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173858, Price codes: A11 in paper copy, A01 in microfiche. In: Proceedings, Stormwater Management Model (SWMM) Users Group Meeting, 19-20 June, 1980, Toronto, Ontario, Environmental Protection Agency Report EPA 600/9-80-064, December, 1980, p 23-44. 6 Fig, 5 Tab, 18 Ref.

Descriptors: *Runoff forecasting, *Model studies, *Storm water, Hydrographs, Rainfall - runoff relationships, Streamflow, Peak discharges, Watersheds(Basins), Infiltration rates, Design storm.

The Soil Conservation Service (SCS) Technical Release 55 (TR-55) presents simplified tabular and graphical methods for estimating runoff volumes, peak discharges and discharge hydrographs for runoff computations. The SCS TR-55 computational procedures and data requirements are critically reviewed. A comparative assessment of peak discharge and hydrograph computations with other widely used models was carried out using several hypothetical watersheds. Limitations introduced by the meteorological input assumptions and the methodology for calculation of infiltration and other losses include: a particular distribution and a specific duration design storm, and weighted averaging of curve numbers for pervious and impervious areas which may lead to overestimation of rainfall losses corresponding to one half to one tenth-year storms. The two procedures for peak discharge computations in TR-55 lead to different results. The second method giving peak flows in terms of areas and slopes seems to significantly underestimate peak flows. For the same meteorological input and rainfall losses, simulations carried out by the time of concentration method underestimated the peak flows for areas up to 160 acres as compared to Storm Water Management Model. The tabular procedures in the SCS TR-55 for routing runoff hydrographs through stream channels seem to underestimate the flows and can be used only in conjunction with a 24 hour, Type II storm. Use of the convex method seems to be more accurate and can be used for any hydrograph profile. (Moore-SRC)
W81-01923

A SIMPLIFIED STORMWATER QUANTITY AND QUALITY MODEL,
Akron Univ., OH. Dept. of Civil Engineering.
S. Sarikelle, and Y-T. Chuang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173858, Price codes: A11 in paper copy, A01 in microfiche. In: Proceedings, Stormwater Management Model (SWMM) Users Group Meeting, 19-20 June, 1980, Toronto, Ontario, Environmental Protection Agency Report EPA 600/9-80-064, December, 1980, p 45-63. 8 Fig, 1 Tab, 13 Ref.

Descriptors: *Urban runoff, *Storm runoff, *Model studies, *Water pollution, Computer programs, Water quality, Storm water, Small watersheds, Hydrographs.

Most existing stormwater models have complicated structure, require extensive input data, and do not incorporate the qualitative aspect of the urban runoff phenomena efficiently. A quantity and quality urban runoff simulation model with simple input requirements was developed to be used in the planning and analysis of stormwater systems. The Modified Linearized Subhydrographs Urban Runoff Model (MLSUPM) consists of a quantity submodel and a quality submodel. The model was applied to two typical urban drainage areas with measured runoff data corresponding to various gaged storm events. The model simulated stormwater hydrograph well for small urban catchments with little calibration effort. The successful simulation of hydrographs for large watersheds is also achieved if the watersheds are subdivided into small catchements. Satisfactory pollutograph simulations were also obtained by using calibrated parameter values. The model may be used as an alternative to the more comprehensive and complex models in the planning and analysis of stormwater systems. It incorporates simple but physically realistic parameters in the simulation of runoff of stormwater. (Moore-SRC)
W81-01924

METHODOLOGY FOR 'LUMPED' SWMM MODELLING,
Edmonton Water and Sanitation Dept. (Alberta).
M. Ahmad.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173858, Price codes: A11 in paper copy, A01 in microfiche. In: Proceedings, Stormwater Management Model (SWMM) Users Group Meeting, 19-20 June, 1980, Toronto, Ontario, Environmental Protection Agency Report EPA 600/9-80-064, December, 1980, p 64-79. 14 Fig, 2 Tab, 7 Ref.

Descriptors: *Urban runoff, *Storm runoff, *Model studies, *Storm drains, Hydrographs, Rainfall-runoff relationships, Urban drainage, Canada, Methodology, Costs.

A systematic methodology is presented for lumping or aggregating urban drainage areas when using the Storm Water Management Model (SWMM) to simulate the rainfall-runoff process. In a lumped model the study area is discretized into large subcatchments, and as such the spatial details of hydrologic characteristics and the internal drainage system are not explicitly modelled. As a part of the simplified methodology, the concept of equivalent gutter was introduced in RUNOFF block simulation to compensate for the eliminated conduit storage existing within the lumped catchment. A set of generalized curves relating in-system conduit storage to impervious area were developed using relevant data from new residential and industrial subdivisions in Edmonton, Canada. Curves relating the drainage area to the peak flow for a range of imperviousness values were also generated. A systematic step by step procedure that uses these curves to determine the overland flow width parameter and the dimensions of the representative equivalent gutter appropriate for the lumped catchment was formulated. The lumping methodology was tested against detailed simulations using rainfall and flow measurements for three recorded storm events for the Norwood test area. Modelling results employing lumped and detailed schemes, respectively, were also compared for the 5-year design storm using the catchment data for the Fulton Drive basin. Comparisons of detailed and lumped simulations for both test areas were found to be reasonably good. A significant reduction both in the amount of effort required in input data preparation and in the overall simulation costs can be achieved by employing this lumping methodology. (Moore-SRC)
W81-01925

CHARACTERIZATION, MAGNITUDE AND IMPACT OF URBAN RUNOFF IN THE GRAND RIVER BASIN,
Ontario Ministry of the Environment, Ottawa. Water Resources Branch.
For primary bibliographic entry see Field 5B.
W81-01926

DEVELOPMENT OF AN URBAN HIGHWAY STORM DRAINAGE MODEL BASED ON SWMM,
Camp, Dresser and McKee Inc., Springfield, VA.
For primary bibliographic entry see Field 8A.
W81-01927

KINEMATIC DESIGN STORMS INCORPORATING SPATIAL AND TIME AVERAGING,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 2B.
W81-01928

HYDROGRAPH SYNTHESIS BY THE HNV-SBUH METHOD UTILIZING A PROGRAMMABLE CALCULATOR,
Howard, Needles, Tammen and Bergendoff, Orlando, FL.
B. L. Golding.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173858, Price codes: A11 in paper copy, A01 in microfiche. In: Proceedings, Stormwater Management Model (SWMM) Users Group Meeting, 19-20 June, 1980, Toronto, Ontario, Environmental Protection Agency Report EPA 600/9-80-064, December, 1980, p 150-177. 36 Fig, 8 Tab, 11 Ref.

Descriptors: *Urban runoff, *Hydrographs, *Model studies, *Runoff, Computer programs, Rainfall-runoff relationships, Urban drainage, Soil properties, California, *Santa Barbara Urban Method(Runoff)

The Howard Needles Version of the Santa Barbara Urban Hydrograph Method (HNV-SBUH Method) is a fairly simple, yet easily applied low cost model for computing design flow hydrographs using either a programmable pocket calculator or a microcomputer. The HNV-SBUH Method with the four standard infiltration curves is an effective method of simulating acceptable runoff hydrographs from urban drainage basins. Hydrographs can be computed in 20 minutes on a programmable calculator and in 10 minutes on a microcomputer by an engineering technician. In this method, the final design hydrograph is obtained by routing the instantaneous hydrograph for each time period, obtained by multiplying the incremental rainfall excesses by the entire watershed area in acres, through an imaginary linear reservoir with a routing constant equivalent to the time of concentration of the drainage basin. Four urban drainage basins of different sizes, locations and character were selected for use in model validation. Runoff hydrographs from residential areas or other urban areas with less than 50% impervious cover are extremely sensitive to antecedent moisture conditions and the infiltration capacity of the soil in the basin such that the use of a more sophisticated model may not be warranted. (Moore-SRC)
W81-01929

A REPRESENTATION OF AN INSTANTANEOUS UNIT HYDROGRAPH FROM GEOMORPHOLOGY,
Mississippi Univ., University. Dept. of Civil Engineering
V. K. Gupta, E. Waymire, and C. T. Wang
Water Resources Research, Vol 16, No 5, p 855-862, October, 1980. 4 Fig, 25 Ref

Descriptors: *Mathematical models, *Geomorphology, *Rainfall-runoff relationships, Hydrographs, Watersheds(Basins), Water levels, Instantaneous unit hydrograph, Streamflow, River basins.

A probabilistic approach for determining the functional form and the parameters of the instantaneous unit hydrograph was developed on the basis of the geomorphology of a river basin. The channel network and the overland flow regions in a river basin satisfy Horton's empirical geomorphologic laws when ordered according to the Strahler ordering scheme. This setting can be employed in a kinetic theoretical framework for obtaining an explicit mathematical expression for the instantaneous unit hydrograph at the basin outlet. Some preliminary physical ideas are developed for estimating the parameters appearing in the instantaneous unit hydrograph representation in terms of empirical geomorphologic laws of stream numbers, stream lengths, etc. The theoretical results were compared with observed flows for three basins in Illinois. There was good agreement with two larger basins, but an underestimation of the peak flow for the third, smaller basin. Thus, the assumption of linearity of rainfall-runoff transformation is questionable for smaller basins. (Small-FRC)
W81-01961

REAL-TIME FORECASTING WITH A CONCEPTUAL HYDROLOGIC MODEL. I. ANALYSIS OF UNCERTAINTY,
Iowa Univ. Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 6A.
W81-01962

REAL-TIME FORECASTING WITH A CONCEPTUAL HYDROLOGIC MODEL. 2. APPLICATIONS AND RESULTS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 6A.
W81-01963

A DEPTH-AREA-DURATION MODEL OF STORM RAINFALL IN THE SOUTHERN GREAT PLAINS,
Science and Education Adminstration, Chickasha, OK.
For primary bibliographic entry see Field 2B.
W81-01964

FAULTING CAUSED BY GROUNDWATER LEVEL DECLINES, SAN JOAQUIN VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, CA.
T. L. Holzer.
Water Resources Research, Vol 16, No 6, p 1065-1070, December, 1980. 5 Fig, 1 Tab, 22 Ref.

Descriptors: *Groundwater, *Land subsidence, *Geological faults, Withdrawal, Hydrogeology, Settlement, Compaction, Irrigation, Water levels, *Water level fluctuations, San Joaquin Valley(CA), Seasonal.

Collected evidence suggests that faulting in the San Joaquin Valley is related to groundwater level declines caused by groundwater withdrawals for crop irrigation. Modern faulting postdates the beginning of water level declines and associated subsidence. Movement detected in a longterm survey was seasonal, corresponding to water level fluctuations. Fault offset was greater in the year with the lower seasonal low water level. Localized differential compaction across the preexisting fault is proposed as the cause of modern fault movement. (Titus-FRC)
W81-01968

A LOGICAL APPROACH TO THE DESIGN STORM CONCEPT,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 6A.
W81-01971

LOW-FLOW CHARACTERISTICS OF STREAMS IN THE UPPER WISCONSIN RIVER BASIN, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
W. A. Gebert.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $8.75 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 80-691 (WRI), July, 1980. 60 p, 7 Fig, 2 Plates, 3 Tab, 17 Ref.

Descriptors: *Low flow, *Streamflow, *Low flow frequency, *Streamflow forecasting, *Regression analysis, Evaluation, Equations, Base flow, Flow characteristics, Flow duration, Flow rates, Wisconsin, *Upper Wisconsin River basin.

Low-flow characteristics of streams in the upper Wisconsin River basin are presented. Included are estimates of low-flow frequency at 10 gaging stations, flow duration at 8 gaging stations, and low-flow frequency characteristics at 13 low-flow partial-record stations and 81 miscellaneous sites. Equations are provided to estimate low-flow characteristics at ungaged sites and at sites where one base-flow discharge measurement is available. The equations were determined from multiple-regression analyses that related low-flow characteristics at gaging stations and low-flow partial-record stations to basin characteristics. The standard error of estimate is provided for each method of estimating the annual minimum 7-day mean flow below which the flow will fall on the average of once in 2 years and once in 10 years. The standard error of estimate for the 7-day 10-year low flow ranged from 9% to 113% depending on the type of data available. Standard error provides the user with the expected degree of accuracy for each method. (USGS)
W81-02026

FLOOD OF FEBRUARY 1980 ALONG THE AGUA FRIA RIVER, MARICOPA COUNTY, ARIZONA,
Geological Survey, Tucson, AZ. Water Resources Div.
B. W. Thomsen.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $4.75 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-767, June, 1980. 1 Sheet, 4 Fig, 2 Ref.

Descriptors: *Floods, *Rainfall, *Runoff, *Arizona, Reservoir releases, Flood flow, Flood discharge, Flood recurrence interval, Historic floods, Flood frequency, Regression analysis, Aerial photography, *Maricopa County(AZ), *Aqua Fria River(AZ), Lake Pleasant(AZ), Waddell Dam(AZ).

The flood of February 20, 1980, along the Agua Fria River below Waddell Dam, Maricopa County, Ariz., was caused by heavy rains during February 13-20. The runoff filled Lake Pleasant and resulted in the largest release--66,600 cubic feet per second--from the reservoir since it was built in 1927; the maximum inflow to the reservoir was about 73,300 cubic feet per second. The area inundated by the releases includes about 28 miles along the channel from the mouth of the Agua Fria River to the Beardsley Canal flume crossing 5 miles downstream from Waddell Dam. The flood of 1980 into Lake Pleasant has a recurrence interval of about 47 years, whereas the flood of record (1919) has a recurrence interval of about 100 years. (USGS)
W81-02027

STREAMFLOW CHARACTERISTICS OF THE YELLOWSTONE RIVER BASIN, MONTANA, THROUGH 1976,
Geological Survey, Helena, MT. Water Resources Div.
L. G. Moore, and R. R. Shields.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120859, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-41, July, 1980. 67 p, 2 Fig, 8 Ref.

Descriptors: *Streamflow, *Flow characteristics, *River basins, *Montana, Data collections, Gaging stations, Crest-stage gages, Low flow frequency, Flow duration, Flood frequency, Surface waters, Water resources development, *Yellowstone River basin(MT).

Statistical summaries of streamflow data for selected stream-gaging and crest-stage gage sites are presented in this report to aid in appraising the hydrology of the Yellowstone River basin, Montana. Streamflow records presented for 45 gaging stations and 45 crest-stage gages for the period of record. Streamflow record collection in the Yellowstone River basin began in 1889. For each gaging station selected for this report, a brief description is given for station location, drainage area, period of record, revisions of previously published records, type and history of gages, regulation and diversions, and extremes of discharge. These data are followed by tables of monthly and annual flow statistics, high-flow and low-flow frequency data, flood-frequency data, flow-duration information, and for natural-flow sites selected basin characteristics. For each crest-stage gage, the brief description consists of location, drainage area, period of record, and type and history of gage. This information is followed by tables of flood-frequency data and selected basin characteristics. (USGS)
W81-02041

AN ANALYSIS OF THE MAGNITUDE AND FREQUENCY OF FLOODS ON OAHU, HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
R. H. Nakahara.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-109902. Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-45, June, 1980. 20 p, 1 Fig, 9 Tab, 9 Ref.

Descriptors: *Floods, *Peak discharge, *Flood frequency, *Regression analysis, *Hawaii, Analytical techniques, Frequency analysis, Flood peak, Flood forecasting, Flood recurrence interval, Watersheds(Basins), Basin characteristics, Gaging stations, Sites, *Oahu(HI).

An analysis of available peak-flow data for the island of Oahu, Hawaii, was made by using multiple regression techniques which related flood-frequency data to basin and climatic characteristics for 74 gaging stations on Oahu. In the analysis, several different groupings of stations were investigated, including divisions by geographic location and size of drainage area. The grouping consisting of two leeward divisions and one windward division produced the best results. Drainage basins ranged in area from 0.03 to 45.7 square miles. Equations relating flood magnitudes of selected frequencies to basin characteristics were developed for the three divisions of Oahu. These equations can be used to estimate the magnitude and frequency of floods for any site, gaged or ungaged, for any desired recurrence interval from 2 to 100 years. Data on basin characteristics, flood magnitudes for various recurrence intervals from individual station-frequency curves, and computed flood magnitudes by use of the regression equation are tabulated to provide the needed data. (USGS)
W81-02042

SEDIMENT SUSPENSION IN TURBULENT PIPE FLOW,
Bechtel, Inc., San Francisco, CA.
For primary bibliographic entry see Field 8B.
W81-02077

GENERAL ALGORITHM FOR ROUGH CONDUIT RESISTANCE,
Wade, Trim and Associates, Taylor, MI.
For primary bibliographic entry see Field 8B.
W81-02078

HYDROLOGIC IMPACT OF DRAINING SMALL DEPRESSIONAL WATERSHEDS,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
I. E. Moore, and C. L. Larson.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 106, No IR4, p 345-363, December, 1980. 9 Fig, 7 Tab, 21 Ref.

Descriptors: *Runoff, *Drainage, *Watershed management, *Minnesota, Flow rates, Mathematical models, Floods, Storms, Small watersheds.

The Minnesota Model for Depressional Watersheds was developed to study the hydrologic impact of draining small watersheds characterized by numerous depressions. The model was applied to two small watersheds in Jackson County, Minnesota, to determine maximum flow rates on a frequency basis and to determine the effects of various types and degrees of drainage on watershed runoff throughout the year. The physical characteristics of the main water course in the watershed represent the major factor influencing peak discharge rates at the watershed outlet. Annual flood flows on the Minnesota River at Mankato suggested that downstream effects of drainage development on large watersheds are much slighter than was indicated by this study on small watersheds. Drainage of individual depres-

sions in the watersheds had less effect on peak flows from high intensity, short duration storms than from low intensity storms and storm melt. (Small-FRC)
W81-02080

DETENTION STORAGE FOR URBAN FLOOD CONTROL,
Espey Huston and Associates, Inc., Dallas, TX.
D. P. Smith, Jr., and P. B. Bedient.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR2, p 413-425, July, 1980. 4 Fig, 6 Tab, 17 Ref.

Descriptors: *Detention reservoirs, *Flood control, *Urbanization, Brays Bayou, Houston, *Texas, Channels, Water policy, Water conveyance, Runoff, Water control, Flood protection, Flood recurrence level, River basin development, Watershed management, Hydrology, Flood forecasting.

The effect of the location and size of detention storage on downstream flood flows in an urbanizing watershed was studied using the Corps of Engineers HEC-1 simulation model. The example chosen was Brays Bayou, Houston, Texas, for which extensive hydrologic and land use data was available. This low-relief area, the scene of rapid upstream urbanization, has a history of severe flood damages in spite of a large flood control project implemented in the 1950's. Storage detention alternatives considered rainfall frequency, peak flows and timing, and land use. A baseline, established using existing development with no detention storage, indicated a 10-year storm as the upper limit. In the case of added development with storage only for this newly built-up area, a 5 year storm could be safely carried by the channel. If detention ponds were available in both existing and future development, a 10-year event would be successfully handled. In the Brays Bayou, added storage areas will not significantly improve flooding conditions because the character of the lower basin dominates. However, in a less urbanized basin, detention storage could protect downstream areas and control sediment and flood waters as the upper basin develops. (Cassar-FRC)
W81-02117

POLITICAL ASPECTS OF URBAN STORMWATER MANAGEMENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
L. A. Brown.
Journal of the Water Resources Planning and Management Divsion, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 265-273, March, 1980. 2 Fig, 3 Tab, 3 Ref.

Descriptors: *Storm water, *Urbanization, *Political aspects, *Flood control, DeKalb County, *Georgia, Atlanta, Decatur, Planning, Storm runoff, Constraints, Drainage programs, Water policy, Administration, Water management(Applied), Regulation, Zoning, Flood plain zoning, River basins.

Management of stormwater during 1973-1979 in DeKalb County, Georgia, with respect to political aspects is described. This county contains 30% of metropolitan Atlanta and the city of Decatur. It was the site of extensive development and flood plain encroachment prior to 1973. Although it was possible to pass development ordinances and zoning requirements that did not require county funds, only short-term projects showing immediate, visible results were of interest to some elected officials. Projects with long-term, general benefits had limited appeal. It is suggested that benefits such as environmental protection, conservation, improved road transportation, better community image, and reduced damages to individuals will concern a broad base of the citizens, who can influence political bodies to implement a stormwater management program. (Cassar-FRC)
W81-02118

FIELD MEASUREMENT OF TRANSVERSE DIFFUSION IN UNDIRECTIONAL FLOW IN A WIDE, STRAIGHT CHANNEL,
Loughborough Univ. of Technology (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W81-02140

2F. Groundwater

A MIXED NUMERICAL ANALYTICAL METHOD FOR GROUNDWATER FLOW SIMULATION,
IBM Scientific Center, Haifa (Israel).
D. Ramm, and D. Chazan.
Water Resources Research, Vol 16, No 5, p 871-880, October, 1980. 10 Fig, 5 Ref.

Descriptors: *Groundwater movement, *Subsurface flow, *Mathematical models, Aquifers, Equations, Wells, Inflow, Water pollution sources, Rivers, Springs, Salts.

A scheme is presented which permits the computation of the complex field behavior in an area which is densely populated with wells, using a coarse grid and a modest computational effort. This method is an efficient way to generate the information which will allow tracking of salt trajectories even in areas containing densely spaced wells because of the assumption that the flow is two dimensional. The method is a tool for solving flow equations, but may also be used to solve the flow problem and in the calibration of a model. A number of examples are presented which demonstrate the accuracy of the scheme. The scheme can be modified to take into account springs, rivers, phreatic aquifers, and multilayered aquifers. This scheme is of importance when a flow of pollutants must be determined in an area with many singularities. (Small-FRC)
W81-01966

VALIDITY OF CUBIC LAW FOR FLUID FLOW IN A DEFORMABLE ROCK FRACTURE,
California Univ., Berkeley.
P. A. Witherspoon, J. S. Y. Wang, K. Iwai, and J. E. Gale.
Water Resources Research, Vol 16, No 6, p 1016-1024, December, 1980. 9 Fig, 2 Tab, 18 Ref.

Descriptors: *Geologic fractures, *Stress, *Flow, *Mathematical studies, Hydrogeology, Flow measurement, Fluid mechanics, Flow characteristics, Geology, Fractures, Permeability, Porosity, Cracks.

Results of a laboratory investigation of fluid flow in deformable rock are presented. Tension fractures were artificially induced in homogeneous samples of granite, basalt and marble, and flow tests under closed conditions were conducted. The investigations included both radial and straight flow geometries and covered apertures ranging from 250 to 4 micrometers. The cubic law for flow in a fracture was confirmed repeatedly, regardless of loading path and frequency of loading process, open or closed fractures, or rock type. The controlling factor in fluid flow and permeability is the size of the fracture aperture. Slight changes in aperture can dominate any other change in the geometry of the flow field. (Titus-FRC)
W81-01969

INSTABILITY IN AQUIFER IDENTIFICATION: THEORY AND CASE STUDIES,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
S. Yakowitz, and L. Duckstein.
Water Resources Research, Vol 16, No 6, p 1045-1064, December, 1980. 2 Fig, 15 Tab, 35 Ref.

Descriptors: *Aquifer characteristics, *Transmissivity, Analysis, *Groundwater movement, Aquifers, Theoretical analysis, Hydrological properties, Head loss, Parametric hydrology, Algorithms, Mathematical studies, Measurement, Model studies.

A discussion of measurement error in transmissivity estimates and aquifer identification schemes is presented, based on theoretical analyses and case studies. An aquifer simulation model was constructed using best estimates of transmissivity and head. Transmissivity estimates were obtained both through programming and with an algebraic method which incorporated field parameters and discharge-recharge values. Radical changes in transmisivity values produced scarcely perceptible changes in head, revealing a problem of sensitivity in aquifer identification. In order for the error covariance to be within usable range the piezometric heads would have to be known to be within a few inches of accuracy. The accuracy problems in the methods presented suggest that the problem of aquifer identification can not be properly addressed by existing models. Results imply that alternative methods such as multidimensional interpolation to estimate heads at unmeasured locations and nonparametric models may produce more useful information. (Titus-FRC)
W81-01972

THEORETICAL HEAD VARIOGRAMS FOR STEADY FLOW IN STATISTICALLY HOMOGENEOUS AQUIFERS,
Princeton Univ., NJ. Dept. of Civil Engineering.
G. R. Chirlin, and G. Dagan.
Water Resources Research, Vol 16, No 6, p 1001-1015, December, 1980. 10 Fig, 1 Tab, 22 Ref.

Descriptors: *Aquifers, *Groundwater movement, *Transmissivity, Flow, Variability, Model studies, Aquifer systems, Boundaries, Hydrogeology, Rock properties, Aquifer characteristics, Head loss, Fluctuations, Statistical methods, On-site tests, Mathematical studies.

A model is presented which produces an expression for the head variogram of an aquifer given a statistical description of the transmissivity field. The model assumes a steady, uniform average flow in a completely random medium of cylindrical blocks whose size and transmissivity are independent. It employs the self-consistent model of flow physics. Limited available data prohibit greater refinement of the model at present. Results in a hypothetical case suggest that kriged standard deviation is overestimated perpendicular to the mean flow and underestimated parallel to it. The model has application in fitting typically inconclusive data points, and contributes to a technique which reduces scattering in plots of variograms from field data. (Titus-FRC)
W81-01973

MAPS SHOWING GROUNDWATER CONDITIONS IN THE HASSAYAMPA AREA, MARICOPA AND YAVAPAI COUNTIES, ARIZONA--1978,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02028

LAND-SURFACE SUBSIDENCE IN THE TEXAS COASTAL REGION,
Geological Survey, Austin, TX. Water Resources Div.
K. W. Ratzlaff.
Available from the OFSS, USGS Box 25425, Fed Ctr., Denver, CO 80225. Price: $3.50 in paper copy, $6.00 in microfiche. Geological Survey Open-File Report 80-969, September, 1980. 19 p, 8 Fig, 24 Ref.

Descriptors: *Land subsidence, *Compaction, *Groundwater, *Overdraft, *Texas, Aquifers, Water levels, Withdrawal, Oil reservoirs, Mining, *Houston-Galveston area(TX).

Land-surface subsidence has been mapped in the Houston-Galveston area and is known to have occurred in other areas within the Texas coastal region. Most of the subsidence has been caused by both the withdrawal of groundwater and by the production of oil, gas, and associated groundwater. Land-surface subsidence was determined by com-

paring adjusted elevations of bench marks for various periods of releveling and by comparing topographic maps of the same areas for different years. In general, most of the Texas coastal region has subsided less than 0.5 foot. The largest amount measured in the region is in the Pasadena-Houston Ship Channel area, where the land surface subsided between 8.5 and 9.0 feet during 1906-73. The cause of the subsidence in this area was groundwater withdrawals. Local subsidence caused by sulfur mining in the Moss Bluff Salt Dome area has been reported to exceed 15 feet. In Jefferson County, the Spindletop Dome area subsided approximately 5 feet during 1925-77, and the Port Acres area subsided about 3 feet during 1959-77, mainly because of withdrawal of oil or gas and associated groundwater. Local subsidence caused by sulfur mining in the Spindletop Dome area has been estimated to exceed 10 feet. In southeastern Jackson County and northwestern Matagorda County, the land surface subsided more than 1.5 feet during 1943-73 as a result of groundwater withdrawals. Withdrawals of oil, gas, and associated groundwater caused more than 5 feet of subsidence during 1942-75 in the western part of Corpus Christi in Nueces County. (USGS)
W81-02031

GROUNDWATER HYDROLOGY OF THE SAGEBRUSH FLAT AREA AND POSSIBLE RELATIONS TO THE DISCHARGE OF RATTLESNAKE SPRINGS, GRANT AND DOUGLAS COUNTIES, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
K. L. Walters.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $4.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 79-1530 (WRI), 1980. 27 p, 9 Fig, 3 Tab, 4 Ref.

Descriptors: *Groundwater, *Water wells, *Aquifers, *Surface-groundwater relationships, *Washington, Hydrogeology, Well data, Water level fluctuations, Pumping, Groundwater movement, Chemical analysis, Hydrographs, Grant County(WA), Douglas County(WA).

In 1978, the U.S. Geological Survey, in cooperation with the State of Washington Department of Ecology, investigated the hydrology of the Sagebrush Flat area as it relates to Rattlesnake Springs. Rattlesnake Springs and all known wells on Sagebrush Flat obtain water from basalt aquifers. The wells tap aquifers at or below the altitude of the spring discharge. Water levels in some wells on Sagebrush Flat, and in a well 27 miles to the northeast in an area of no groundwater development, show slight fluctuations that may correspond to annual variations in precipitation. However, hydrographs of most wells on Sagebrush Flat show water-level declines and rises that correspond with the beginning and end of the pumping season. The discharge of Rattlesnake Springs started to decrease at about the beginning of the 1978 pumping season and did not start to increase until after most pumping was stopped. The water level in deep aquifers beneath Sagebrush Flat is at a lower altitude than in shallow a quifers, and water moves down well boreholes from shallow aquifers to deeper aquifers. This downward movement of water diverts groundwater that is moving toward natural discharge points such as Rattlesnake Springs, thereby decreasing the discharge at these points. (USGS)
W81-02032

WATER-SUPPLY ASSESSMENT OF THE LARAMIE-FOX HILLS AQUIFER IN PARTS OF ADAMS, BOULDER, JEFFERSON, AND WELD COUNTIES, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-02033

GROUNDWATER AVAILABILITY IN CARBONATE ROCKS OF THE DANDRIDGE AREA, JEFFERSON COUNTY, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
E. F. Hollyday, and P. L. Goddard.
Geological Survey Open-File Report 79-1263 (WRI), 1980. 50 p, 22 Fig, 9 Tab, 8 Ref.

Descriptors: *Groundwater, *Groundwater availability, Karst, Limestones, *Tennessee, *Carbonate rocks, Groundwater movement, Hydrogeology, Aquifer characteristics, Natural recharge, Water wells, Water yield, Physical properties, Hydrologic data, *Jefferson County(TN), Valley and Ridge physiographic province.

Groundwater in Jefferson County, Tenn., occurs in solution openings that follow bedding planes and strike joints in the dense limestone and dolomite. Recharge beginning at topographic highs in the northwest moves across strike to lows in the southeast; it is intercepted and collected by high permeability beds in the middle of the Knox Group and is routed along strike to discharge at large springs. Exploratory wells were drilled at two sites to test this concept of the flow system. Three wells at Moore Spring site in the recharge area penetrated only mud and solid rock. Four wells at Riley Spring site in the discharge area each penetrated at least five water-bearing openings that gave these wells an average production of 93 gallons per minute and a maximum of 180 gallons per minute. (USGS)
W81-02034

GROUNDWATER MODELS FOR WATER RESOURCES PLANNING,
Geological Survey, Reston, VA. Water Resources Div.
J. E. Moore.
Geological Survey Open-File Report 80-581, 1980. 22 p, 11 Ref.

Descriptors: *Groundwater resources, *Computer models, *Model studies, *Planning, Analog models, Groundwater movement, Mathematical models, Water resources development, San Luis Valley(CO), Arkansas River Valley(CO), Rocky Mountain Arsenal(CO), Southwest Florida, Forecasting, Groundwater availability, Water quality.

In the past decade hydrologists have emphasized the development of computer-based mathematical models to aid in the understanding of flow, the transport of solutes, transport of heat, and deformation in the groundwater system. These models have been used to provide information and predictions for water managers. Too frequently, groundwater was neglected in water-resource planning because managers believed that it could not be adequately evaluated in terms of availability, quality, and effect of development on surface water supplies. Now, however, with newly developed digital groundwater models, effects of development can be predicted. Such models have been used to predict hydrologic and quality changes under different stresses. These models have grown in complexity over the last 10 years from simple one-layer flow models to three-dimensional simulations of groundwater flow which may include solute transport, heat transport, effects of land subsidence, and encroachment of salt water. This paper illustrates, through case histories, how predictive groundwater models have provided the information needed for the sound planning and management of water resources in the United States. (USGS)
W81-02035

HYDROLOGY OF THE SELDOVIA AREA, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
G. L. Nelson, and W. R. Danskin.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.50 in paper copy, $1.00 microfiche. Geological Survey Open-File Report 80-952 (WRI), 1980. 2 Sheets, 5 Fig, 2 Tab, 5 Ref.

Descriptors: *Hydrogeology, *Groundwater, *Surface waters, *Water resources, *Alaska, Glacial drift, Aquifers, Water wells, Water pollution sources, Streamflow, Water utilization, Chemical analysis, *Seldovia area(AK), Kenai Peninsula(AK), Cook Inlet(AK).

Surficial materials in the Seldovia area, Alaska, are mapped as glacial drift over sedimentary bedrock, glacial drift over igneous and metamorphic bedrock, valley-bottom, alluvium, alluvial fan deposits, beach and intertidal deposits, and peat. Unconsolidated materials are generally less than 10 feet thick except in well-drained glacial deposits along the Seldovia-Jakolof Bay Road and in depressions in the bedrock surface. These depressions are poorly drained and commonly contain peat bogs. Development of domestic wells (1-15 gallons per minute) may be possible from unconsolidated materials and sedimentary bedrock, but larger water requirements must be met from surface-water sources. In areas having the water table or top of bedrock at shallow depths, effluent from sewage disposal systems may cause pollution of the land surface and nearby surface water. Seepage from hillside aquifers and unstable land along the coast of Kachemak Bay may adversely affect roads and structures. (USGS)
W81-02037

2G. Water In Soils

SURVEY OF METHODS FOR SOIL MOISTURE DETERMINATION,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
T. J. Schmugge, T. J. Jackson, and H. L. McKim.
Water Resources Research, Vol 16, No 6, p 961-979, December, 1980. 13 Fig, 2 Tab, 169 Ref.

Descriptors: *Soil moisture, *Remote sensing, *Measurement, Application methods, Soil physics, Moisture content, Subsurface waters, Evapotranspiration, Evaporation, Instrumentation, Hydrological cycle, Transpiration, Methodology, Testing procedures, On-site tests, Analytical techniques.

A survey of methods for determining soil moisture is presented. The three general approaches are in situ or point measurements, soil water models, and remote sensing. All methods should meet three requirements: frequent observations, an estimate of moisture within the top 1-2 meters of soil, and a description of moisture variations over a large expanse, such as a county or state. In situ methods include gravimetric, nuclear and electromagnetic techniques. These are only accurate at the point of measurement and would require considerable manpower. Soil water models are based on meteorological parameters including precipitation and evapotranspiration. These methods provide fast answers for large areas, but require costly data which can be difficult to obtain and can introduce error into the models. Remote sensing uses solar, thermal infrared, and microwave radiation. It offers rapid data collection over large areas on a repetitive basis. However, spatial resolution and cost are limitations. An integrated system of soil moisture determination which combines various approaches is suggested as the most cost-effective and informative method. (Titus-FRC)
W81-01970

A SIMPLIFIED FUNCTIONS APPROACH FOR DETERMINING SOIL HYDRAULIC CONDUCTIVITIES AND WATER CHARACTERISTICS IN SITU,
Hawaii Univ., Honolulu. Water Resources Research Center.
L. R. Ahuja, R. E. Green, and S-K. Chong.
Water Resources Research, Vol 16, No 5, p 947-953, October, 1980. 17 Fig, 16 Ref. OWRT-B-054-HI(4).

Descriptors: *Theoretical analysis, *Soil water movement, Watersheds, Drainage, Model studies, Mathematical models, Darcy's law, Groundwater movement, *Hydraulic conductivity, Soil moisture.

In order to determine the hydraulic conductivity and soil water content of a watershed soil from minimum in situ field measurements, it was as-

sumed that the former was a piecemeal power form and the latter a linear logarithmic function of the soil water suction. The values of these functions were measured by analysis of drainage phase tensiometric data plus field values of near saturated conductivity and one sampling of soil moisture during drainage. The theory set forth allows the calculation of the unsaturated hydraulic conductivity and diffusivity without the prior knowledge of soil water features which is required for Darcian analysis, a more rigorous method. The model was applied to field measurements taken on four Hawaiian soils and one California soil with generally satisfactory results. In some instances where there were differences in the conductivity values for very small suctions, the discrepancies were attributed to field measurement errors or the use of soil core water characteristics for the very wet region in the Darcian system. Although the slope parameter of the water characteristic function was more sensitive to the scatter in the input data, the overall simplified method seemed promising for use in computing soil water content and saturated hydraulic conductivity. (Geiger-FRC)
W81-01999

RAIN INFILTRATION INTO LAYERED SOILS: PREDICTION,
Mosul Univ. (Iraq). Dept. of Irrigation Engineering.
A. Y. Hachum, and J. F. Alfaro.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 106, No IR4, p 311-319, December, 1980. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Wetting, *Rainfall, *Mathematical models, Infiltration, Soil moisture, Soil water movement, Hydrologic properties, Irrigation, Nonuniform soils, *Layered soils.

The Green-Ampt approach for describing vertical infiltration into nonuniform soils is extended to rain applications. The model contains three measurable input parameters which are based on properties and initial soil profile conditions. Darcy's law is combined with the continuity principle subjected to the assumptions of a sharp abrupt wetting front, a constant hydraulic conductivity in the wetted zone, a constant water pressure head at the wetting front, and negligible effect of raindrops in the infiltration process. Model performance was compared to results with a second model derived from general flow theory, and good agreement was found. Results are compared for different soil profiles and rain intensities. Numeric examples are given. The conditions under which soil surface saturation and water ponding occur are examined. The model is shown to be a useful, workable tool in irrigation and hydrology to approximate infiltration in soils which are not uniform. (Small-FRC)
W81-02092

AN IMPROVED PROCEDURE FOR MEASURING WATER RETENTION CURVES AT LOW SUCTION BY THE HANGING-WATER-COLUMN METHOD,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel).
P. Berliner, P. Barak, and Y. Chen.
Canadian Journal of Soil Science, Vol 60, No 3, p 591-594, August, 1980. 3 Fig, 4 Ref.

Descriptors: *Instrumentation, *Retention, Soil water, Soil physical properties, Soil texture, Soil moisture, Soil water movement, Soil-water-plant relationships, Evaporation, Water retention, *Soil moisture retention, *Israel.

An improved method for measuring soil water retention curves at low suction levels of 0-300 mbar by the hanging-water-column technique is described. The procedure involves weighing the released water without disconnection of the cell from the tubing, resulting in a level of precision of + or - 0.01 g water. Errors from volumetric changes due to evaporation are avoided, and equilibrium at each point is attained with ease. The apparatus consists of a balance, a fritted glass funnel, flexible latex tubing and a glass Mariotte tube that is lowered to produce a hanging water column. Three soils from Israel were analyzed by conventional equipment and the new device, and the retention curves obtained by the two methods were compared. Good agreement was obtained in triplicate trials performed by the present technique, as well as between these results and those obtained by the conventionally used procedure. (Geiger-FRC)
W81-02147

2H. Lakes

SOME CONSIDERATIONS ON THE DENSE POPULATION OF A PURPLE SULFUR BACTERIUM, CHROMATIUM SP. AT THE MID-DEPTH OF LAKE KAIIKE,
Nagasaki Univ. (Japan). Faculty of Fisheries.
M. Matsuyama.
Japanese Journal of Limnology, Vol 41, No 2, p 84-94, April, 1980. 8 Fig, 27 Ref.

Descriptors: *Bacteria, *Sulfur bacteria, *Lakes, *Stratification, *Chromatium sp, Hydrogen sulfide, *Lake Kaiike(Japan), Japan, Reduction(Chemical), Aquatic bacteria, Algae, Aquatic plants, Light penetration, Aquatic environment, Phosphorus compounds, Nitrogen compounds, Nutrients, Light intensity, Aphotic zone, Penetration.

A dense population, 5 million cells per ml, of a purple sulfur bacterium, Chromatium sp., was found in a thin horizontal layer at mid-depth, 4.75 meters, in the small stratified lake, Lake Kaiike, Kamikoshiki Island, Japan. Although this bacterium grows more slowly than algae, it uses the inorganic nutrients and hydrogen sulfide produced in the deeper water, permitting little nutrient material to rise into the upper layers for utilization by algae. Light attenuation studies showed that the bacterial plate significantly decreases light available below it. The layer of water beneath the bacteria was in a reducing condition, containing hydrogen sulfide at a maximum level of 19 mg S per liter at 5.5 meters depth and no dissolved oxygen below 4.75 meters. (Cassar-FRC)
W81-01977

CHANGES IN PHOSPHORUS CONCENTRATIONS DUE TO MIXING BY MOTORBOATS IN SHALLOW LAKES,
University of Central Florida, Orlando. Engineering and Industrial Experiment Station.
Y. A. Yousef, W. M. McLellon, and H. H. Zebuth.
Water Research, Vol 14, No 7, p 841-852, July, 1980. 9 Fig, 8 Tab, 22 Ref

Descriptors: *Phosphorus, *Lakes, Chlorophyll, Boating, Productivity, Recreation, Turbidity, Dissolved oxygen, Statistical methods, Hydrogen ion concentration, Florida, Water quality, Mixing, Shallow water, Motorboats, Effects.

Changes in water quality due to mixing by motorboats were studied in shallow lakes of Central Florida. The three lakes, Lakes Claire, Mizell and Jessup, differed in average water depth, sediment characteristics and trophic state. Significant increases in turbidity and ortho- and total phosphorus concentrations were demonstrated in water samples collected after mixing by motorboats in Lakes Claire and Jessup. The results obtained from Lake Mizell were not as conclusive. The increase in the orthophosphorus content for Lakes Claire, Mizell and Jessup averaged 43, 16, and 73%; the increase in total phosphorus content for the same three lakes was 39, 28, and 55%. Positive correlations existed between turbidities and the phosphorus content in the water column. The authors also demonstratd that the rate of increase in the phosphorus content with mixing time is much higher than the rate of decline after cessation of mixing. Data indicated substantial water quality effects are possible due to recreational boating on shallow lakes. (McKeon-FRC)
W81-02007

2I. Water In Plants

SOYBEAN ROW SPACING AND SOIL WATER SUPPLY: THEIR EFFECT ON GROWTH, DEVELOPMENT, WATER RELATIONS, AND MINERAL UPTAKE,
Iowa State Univ., Ames. Dept. of Agronomy
W. K. Mason, H. M. Taylor, A. T. P. Bennie, H. R. Rowse, and D. C. Reicosky.
Science and Education Administration, Peoria, Illinois. Advances in Agricultural Technology Report AAT-NC-5, November, 1980. 63 p, 11 Fig, 33 Tab, 36 Ref.

Descriptors: *Soybeans, *Irrigation effects, *Planting management, Field crops, Agronomy, Solar radiation, Plant growth, Biomass, Nutrients, Moisture stress, Soil moisture.

The growth, development, water and nutrient use, and yield were monitored for soybeans grown in wide (1.0m) and narrow (0.25m) rows under irrigated and nonirrigated conditions to clarify why narrow row soybeans often produce greater yields. Irrigation increased plant height, leaf area, and biomass production and slowed both vegetative and reproductive development. Planting soybeans in 1.0m rows rather than 0.25m rows increased plant height, biomass production and pod number, and speeded reproductive development. The more even canopy distribution of the narrow rows resulted in greater radiation interception. With the significant increases in biomass production caused by irrigation and wide row spacing, the final seed yield results are somewhat surprising. The 0.25m row spacing significantly outyielded the 1.0m row spacing, and irrigation had no significant effect on yield except to reduce seed size. No effect of row spacing on total leaf water potential or osmotic potential was found under irrigated or nonirrigated conditions. Results indicate that yield in the irrigated plots was limited by low radiation levels, by low temperatures, or both, just before maturity, and the 0.25m rows outyielded the 1.0m rows because of greater late-season solar radiation interception. (Moore-SRC)
W81-01942

LINEARIZED MOISTURE FLOW WITH ROOT EXTRACTION FOR THREE DIMENSIONAL, STEADY CONDITIONS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
A. W. Warrick, D. O. Lomen, and A. Amoozegar-Fard.
Soil Science Society of America Journal, Vol 44, No 5, p 911-914, September/October, 1980. 4 Fig, 1 Tab, 11 Ref. OWRT-B-064-ARIZ(5)

Descriptors: *Soil-water-plant relationships, *Irrigation systems, Unsaturated flow, Soil moisture, Equations, Trickle irrigation, Moisture, Soil water movement.

A mathematical model is presented to simulate plant water uptake in situations such as trickle irrigation. Geometries considered have radial symmetry and include matrix potentials for points, discs, and cylinders. The cylinder solution is new. Assumptions include a hydraulic conductivity exponentially related to pressure head, uniform soil, and negligible evaporation loss. Four examples are given to illustrate source-sink combinations: cylinder, buried disc, damped cylinder, and double cylinder. (Cassar-FRC)
W81-01998

2J. Erosion and Sedimentation

THE DISTRIBUTION OF KINETIC ENERGY OF RAINFALL IN SOUTH AFRICA - A FIRST ASSESSMENT,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2B
W81-01957

TRAP EFFICIENCY STUDY, HIGHLAND CREEK FLOOD RETARDING RESERVOIR NEAR KELSEYVILLE, CALIFORNIA, WATER YEARS 1966-77,
Geological Survey, Menlo Park, CA. Water Resources Div.
L. F. Trujillo.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-735, July, 1980. 25 p, 7 Fig, 8 Tab, 12 Ref.

Descriptors: *Trap efficiency, *Detention reservoirs, *Sediments, *California, Inflow, Discharge(Water), Water storage, Sediment transport, Particle size, Chemical analysis, Lake County(CA), Kelseyville(CA), Highland Creek Reservoir(CA).

This investigation is part of a nationwide study of trap efficiency of detention reservoirs. In this report, trap efficiency was computed from reservoir inflow and outflow sediment data and from reservoir survey and outflow data. Highland Creek Reservoir is a flood retarding reservoir located in Lake County, near Kelseyville, California. This reservoir has a maximum storage capacity of 3,199 acre-feet and permanent pool storage of 921 acre-feet. Mean annual rainfall for the 14.1-square-mile drainage area above Highland Creek Dam was 29 inches during the December 1965 to September 1977 study period. Resultant mean annual runoff was 17,100 acre-feet. Total reservoir inflow for the 11.8-year study period was 202,000 acre-feet, transporting an estimated 126,000 tons (10,700 tons per year) of suspended sediment. Total reservoir outflow for the same period was 188,700 acre-feet, including 15,230 tons (1,290 tons per year) of sediment. Estimated trap efficiency for the study period was 88%, based on estimated sediment inflow and measured sediment outflow. Reservoir surveys made in December 1965 and April 1972 revealed a storage capacity loss of 35.8 acre-feet during the 6.3-year period. Computed by using an estimated specific weight, this loss represents 54,600 tons of deposited sediment. Sediment outflow during the same period was 8,890 tons. Trap efficiency for the survey period was 86%. (USGS)
W81-02030

SUBMERGED HORIZONTAL JET OVER ERODIBLE BED,
Jalpaiguri Government Engineering Coll. (India).
S. S. Chatterjee, and S. N. Ghosh.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY11, p 1765-1782, November, 1980. 9 Fig, 2 Tab, 9 Ref.

Descriptors: Velocity, *Stream erosion, *Flow, Hydraulics, Jets, Erosion, *Sediment transport, Alluvium, Shear, Boundary processes, Sediments, Friction, Geomorphology, Mathematical studies, Rates, Diffusion, Sands.

An experimental investigation of sediment transport due to horizontal jet flow over erodible sand and gravel beds is discussed. Test runs of jet flows were undertaken with two erodible beds with different grain size distributions. Using the data, the shear stress acting over the bed during the development of a scour hole was evaluated, and sediment transport was computed. From the experimental data the velocity distribution law within the boundary layer and the expression for the growth of its thickness with distance have been derived. An expression for critical shear stress was derived. At the location of maximum scour an expression for the pressure-shear relationship for a Preston tube was obtained. Results indicate that the effect of grain-size characteristics of the bed material on the development of boundary shear is increasingly felt as the equilibrium stage is approached. The growth and thickness of the boundary layer have been found to be dependent on the flow depth, grain size, and distance from the sluice opening. There is discrepancy between values calculated for the sand bed, but there is good agreement of values for the gravel bed. (Titus-FRC)
W81-02079

2L. Estuaries

AN ASSESSMENT OF STORM SURGE MODELING.
Water Resources Council, Washington, DC.
Report, 1980. 43 p, 43 Ref.

Descriptors: *Storm surges, *Model studies, *Hurricanes, Computer models, Surges, Coasts, Floods, Mathematical models, Storms, Oceans, Meteorological data, Hydrodynamics, Forecasting.

Of the many phenomena affecting the coastlines of the United States, storm surges cause the greatest damage. Techniques for accurately estimating storm surge water levels are essential to the dissemination of information to warn people of storm surges, to the design of coastal protective works, and to the reduction of economic loss and human suffering. Several numerical models are currently being used to estimate hurricane-produced storm surges, with each model having its own advocates and sphere of application. Open coast storm surge models, including the SPLASH Model, SSURGE Model, FIA Model, and BATHYSTROPHIC Model, were reviewed. A detailed model assessment was not possible, but the initial review indicated that: some models had not been adequately tested; adequate data for testing was not readily available; and the models were sufficiently different that direct comparison of algorithms could not be made. Specific recommendations which would provide the basis for a decision on the use of a particular model and could be used in future standardization efforts include: model documentation; the decoupling of storm and surge models; model calibration and verification; model selection based on simulations of historic data, sensitivity studies, and economics of model application; consideration of inland flooding and extra tropical storm modeling; and the development of a permanent system for the collection, storage, and retrieval of meteorological and surge data. (Moore-SRC)
W81-01935

MATHEMATICAL MODELING OF CIRCULATION IN BAKER BAY, WASHINGTON/OREGON,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
J. A. Roberson, H. D. Copp, and B. Naik.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-177693, Price codes: A06 in paper copy, A01 in microfiche. Technical Report HY-4/80, September 30, 1980. 106 p, 19 Fig, 1 Tab, 13 Ref, 2 Append. OWRT-A-099-WASH(1), 14-34-0001-9051.

Descriptors: Computer modeling, Hydraulics, *Estuaries, *Bays, *Water circulation, Forecasting, *Baker Bay, Washington, Oregon, Model studies, *Tidal effects, *Sedimentation, Mathematical models, Columbia River.

A two-dimensional, vertically averaged, mathematical model was developed to simulate hydraulic circulation of Baker Bay at the mouth of the Columbia River in Washington/Oregon. An existing model was modified so shoal areas that become exposed during low tides would be created realistically during simulation. Baker Bay is bounded on the south of the Columbia River with two islands along this boundary. The inital conditions for a given run are the tide level and velocity (zero) for flood tides. The model must be run one complete tide cycle before circulation predictions in the bay are representative of the actual circulation. Comparison of computed velocities and depths with rather meager field data indicates the model performs adequately. The model was used to examine certain possible modifications to the bay at the boundary with the Columbia River to assess how bay circulation might change. Sediment deposition has restricted movement of commercial ships and pleasure craft into and out of the bay; more intense circulation velocities would help to maintain adequate depths in ship channels and in the bay generally. Modifications examined influenced internal circulation only slighly but some showed promise of improving velocities locally in existing channels near the bay/river boundary. Additionally, more detailed investigations are needed prior to undertaking remedial works.
W81-02010

WATER QUALITY IN RHODE RIVER AT SMITHSONIAN INSTITUTION PIER NEAR ANNAPOLIS, MARYLAND, JANUARY 1976 THROUGH DECEMBER 1978,
Geological Survey, Edgewater, MD. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-02040

TIDAL AND DIEL FLUCTUATIONS IN THE TEMPORAL CONCENTRATIONS OF CHLOROPHYLL A AND PHEOPHYTIN AT A STATION MONITORING A HIGH-MARSH CREEK,
South Carolina Univ., Columbia. Dept. of Biology.
C. W. Erkenbrecher, Jr., and L. H. Stevenson.
Journal of Experimental Marine Biology and Ecology, Vol 48, No 3, p 253-261, December, 1980. 4 Fig, 3 Tab, 14 Ref.

Descriptors: *Estuaries, *Diel migration, *Phytoplankton, Sampling, Tidal effects, Chlorophyll, Pheophytin, Temporal distribution, Solar radiation, Fluctuations, Variability, Water level fluctuations, Oyster Landing Creek, South Carolina, Pigments, Plant pigments, Marine biology.

Pheophytin level fluctuations in a high-marsh creek were strongly influenced by tides; chlorophyll a concentrations were affected by complex, superimposed tidal and diel rhythms. Sampling done in Oyster Landing Creek, North Inlet Estuary, South Carolina, during May, June, August, and October showed a mean chlorophyll a concentration of 3.02 mg per cu meter (range 0.13 to 11.44) and pheophytin, 1.77 (range 0.01 to 8.49). During May and June solar radiation caused marked increases of chlorophyll a during the day, peaking at mid-afternoon. Pheophytin levels were not similarly affected, but were correlated with the tides, minimum at high tide and maximum at low tide. Both pheophytin and chlorophyll a had a negative correlation with water depth. Therefore, tidal cycles and sampling dates are factors in planning the sampling of phytoplankton for species composition, productivity, and seasonal effects. (Cassar-FRC)
W81-02076

CONTRIBUTION OF MARINE ALGAE TO TRIHALOMETHANE PRODUCTION IN CHLORINATED ESTUARINE WATER,
Environmental Research Lab., Johns Island, SC. Bears Bluff Field Station.
For primary bibliographic entry see Field 5B.
W81-02131

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALINATION: A PRACTICAL PROCESS,
National Inst. of Water Research, Pretoria (South Africa).
G. R. Botha.
Imiesa (Johannesburg), Vol 4, No 5, p 43, 45, 47, May, 1979. 2 Fig, 2 Tab.

Descriptors: *Desalination, *Desalination processes, *Distillation, *Electrodialysis, *Reverse osmosis, Freezing, Ion exchange, Membrane processes, Solar distillation, Energy requirements, Vapor compression distillation, Demineralization, Water purification, Brackish water, Saline water, Multistage flash evaporation.

Despite technological advances and the improved efficiency of desalination processes, the cost of desalination will continue to rise due to increasing energy and materials costs, making desalination

desirable only when water from conventional sources is unavailable or extremely expensive. Distillation is the oldest and most widely used desalination process, accounting for 78% of the total world capacity. Types of distillation include multistage flash evaporation, vapor compression, and solar distillation. Freezing is also recognized as a desalination process but many problems remain unsolved and the process is not yet technically or economically viable. Electrodialysis accounts for about 3% of the total world desalination capacity, however, it suffers from membrane fouling problems. Reverse osmosis represents 17% of the world capacity and offers low energy requirements and is comparatively simple. Ion exchange desalination is restricted to the preparation of boiler feed water from brackish water. The salinity of the water to be treated greatly effects the energy requirements and efficiency of the various processes. Efforts must be made to prevent the mineralization of water so that expensive desalination processes will not be increasingly needed. (Seigler-IPA)
W81-02053

3D. Conservation In Domestic and Municipal Use

PERCEPTION OF WATER QUALITY IN SOME VILLAGES OF THE SAVANNA ZONE OF NIGERIA,
Ibadan Univ. (Nigeria). Dept. of Geography.
F. O. Akintola, C. Acho-Chi, and S. Mark.
Water Supply and Management, Vol 4, No 4, p 243-252, 1980. 2 Fig, 6 Tab, 5 Ref.

Descriptors: *Water quality, *Rural areas, Water supply, Surveys, Water resources development, Public health, Future planning, Water management, Social aspects, Human diseases, Potable water, *Nigeria.

The water quality and supply situation of three villages of rural Savanna Nigeria were examined, and particular efforts were made to assess the inhabitants' perception of water quality to aid in the future planning of rural water supply programs. Results showed the quality of the water to be generally poor; often drinking water supplies were boiled, as the same water source may have been used for wading or laundering. There was a high incidence of water-borne diseases. The shortage of water was most prevalent during the dry season when ponds and wells, the major water sources, were very shallow. Villagers spent many hours each day fetching water from distant supply wells for domestic use. The people studied showed a keen awareness of water quality and used water from different sources for different purposes. It was recommended that the government provide more pipe-borne water supplies, wells, and boreholes to increase water supply and quality. The villagers are being encouraged to locate bathrooms, latrines, and laundry facilities far from drinking supplies. Education of the populace is also suggested to impress upon the people the value of good quality water to their personal health and hygiene. (Geiger-FRC)
W81-01949

A COST-BENEFIT ANALYSIS OF WATER USE RESTRICTIONS,
Johns Hopkins Univ., Baltimore, MD.
S. H. Hanke.
Water Supply and Management, Vol 4, No 4, p 269-274, 1980. 1 Fig, 1 Tab, 5 Ref.

Descriptors: *Mathematical models, *Cost-benefit analysis, Model studies, Water utilization, Water demand, Water conservation, Marginal costs, Consumptive use, Water costs, Droughts, Water shortage, *Australia, Perth(Australia).

A mathematical formula for determining cost-benefit values for water use restriction programs is presented. Data obtained on water use in Perth, Australia, for 1975-1976 are employed to test the utility of the model during periods corresponding to drought conditions when water use curtailments would have been in operation. The equations set forth are based on the assumption that a policy which yields incremental benefits greater than its incremental costs is a desirable policy and should be adopted. Calculations of marginal water costs using the model were conducted under conditions of restricted and non-restricted use. Four rules were deduced from data generated by the study concerning the economics of water use restrictions. It was concluded that water use restrictions would be uneconomical if prices were set equal to or above marginal costs. The restriction of water use according to the model would always be economical if prices were set below marginal costs and if restrictions did not reduce consumption below its proper level. Another rule of the model held that water use restrictions may or may not be economical if prices were set below marginal costs and if restrictions reduced consumption below its proper level. (Geiger-FRC)
W81-01952

DOMESTIC WATER METERS IN SOUTH AFRICA,
R. M. Burle.
Municipal Engineer (Johannesburg), Vol 10, No 3, p 27, May/June, 1979.

Descriptors: *South Africa, Measurement, *Water metering, *Water conservation, Low flow, Water consumption, Accuracy, Design criteria, Domestic water, Cost effectiveness, Water loss, Leakage, Design criteria, Water meters.

South Africa is experiencing high water metering costs, large water losses, and poor control over its water due to the incompatibility between meter design and actual installation conditions. Strict Assize regulation generally specify the use of a positive displacement type of meter in the form of a positive rotary piston meter. These meters are highly accurate under 'ideal' conditions. 'Ideal' conditions seldom exist due to factors including the use of the smallest possible meter for homes to restrict water use, rising living standards and increased water consumption, and dissolved solids and grit particles in the water. To counter this problem, meter design should take into account adverse installation conditions. This will, in time, allow meter design to reflect long-term cost considerations. (Seigler-IPA)
W81-02046

ENERGY AND WATER CONSERVATION RESEARCH AND THE LOCAL AUTHORITY,
National Building Research Inst., Pretoria (South Africa).
T. L. Webb.
Imiesa (Johannesburg), Vol 4, No 6, p 37, 39, 41, June, 1979. 2 Fig.

Descriptors: *South Africa, *Water conservation, *Energy conservation, *Engineering personnel, Training, Building codes, Fossil fuels, Human population, Solar energy, Energy resources, Plumbing, Information dissemination.

Local town and city engineers can facilitate energy and water conservation efforts in the following ways: by applying and incorporating research findings in the areas under their control, by assisting and collaborating with research activities, and by disseminating the information gained from research. Local South African engineers are responsible for the services of 80% of the country's people and in this position they can directly aid in energy and water conservation. To achieve energy conservation of fossil fuel resources, the amount of energy used must be reduced and replaced by alternative, preferably renewable, energy sources. Three courses of action are complementary to this reduction: education of policy makers and the public, implementation of economic measures to promote conservation, and legislation to enforce conservation measures. South Africa's National Building Research Institute is guiding research areas so that the results will be meaningful and practical. (Seigler-IPA)
W81-02047

URBAN WATER ECONOMY: A MASTER PLAN,
National Building Research Inst., Pretoria (South Africa).
P. R. Crabtree.
Imiesa (Johannesburg), Vol 4, No 5, p 27-29, 31, 65, May, 1979. 1 Fig.

Descriptors: *South Africa, *Water conservation, *Municipal water, Water closets, Urinals, *Plumbing, Cities, Urbanization, Economic efficiency, Measurement, Toilets, Water utilization, Leakage, Swimming pools, Pressure reduction.

The South African Bureau of Standards and the Water Research Commission have organized a project to study the design and usage of water supply fittings and to establish criteria for the National Building Regulations in an effort to promote water savings and conservation. This project is based on the concept that water-closets and urinals have the greatest potential for reducing water consumption in buildings. Once building specifications have been determined, an approved system will be enacted to ensure that only fittings and appliances of acceptable standards are used. Codes of practice will be drawn up for plumbing and drainage in buildings; for gardens, parks, and recreational facilities; and for municipal water distribution systems. Block metering as well as individual flat metering are being studied for their conservation potential and accuracy. Pressure reduction is another conservation technique being studied. Other areas under investigation include the design of baths and basins, leakage reduction, and water consumption in private swimming pools. The need for a campaign to generate public awareness of the need for water conservation is also recognized. (Seigler-IPA)
W81-02063

THE EFFECT OF METERING ON URBAN WATER CONSUMPTION,
Durban City Engineer's Dept. (South Africa).
D. C. Macleod.
Municipal Engineer (Johannesburg), Vol 10, No 3, p 23-26, May/June, 1979. 1 Fig, 5 Tab.

Descriptors: *South Africa, Measurement, Water demand, *Water costs, *Water conservation, Instrumentation, Water consumption, Capital costs, Leakage, Tariffs, Urbanization, Cities, Water supply, Water rates, Water utilization, *Water metering, *Durban.

A Universal Metering Program was initiated in Durban, South Africa, in 1971 and results show an actual consumption level 40% less than the expected level of consumption. The Durban water supply system serves not only the 751,265 residents of the city itself, but it also serves numerous other areas which lie within a 27 km radius of the city. Since 1971, 61,014 meters have been installed at a cost of R2,262,863. Including out-of-city meters, there are now a total of 74,962 metered connections. Due to problems with meter size and quality, specification for meters have been issued. Three basic tariffs are applied, an in-city tariff, an out-of-city tariff, and some special bulk agreements. The large drop in consumption was not all due to metering, the economic recession had an additional depressing effect. Although the capital cost of the metering program was high, it was still less than would have been needed to expand water conservation and purification works to meet higher demands. Also, the metering cost is offset by the ability to detect serious leakage. Since consumers have adjusted to paying for water, the rate of growth of demand has returned to nearly the rate seen before the metering program. (Seigler-IPA)
W81-02066

3F. Conservation In Agriculture

SNOWFALL AND ITS POTENTIAL MANAGEMENT IN THE SEMIARID CENTRAL GREAT PLAINS,
Science and Education Administration, Akron, CO. Central Great Plains Research Station.
B. W. Greb
Science and Education Administration, Oakland, California. Agricultural Reviews and Manuals

ARM-W-18, December, 1980. 50 p, 10 Fig, 24 Tab, 28 Ref.

Descriptors: *Great Plains, *Snow management, *Water conservation, Semiarid climates, Snow surveys, Vegetation effects, Windbreaks, Snowmelt, Strip cropping, Winds, Wheatgrasses, Snowpacks, Crop production, Irrigation water.

In 1955, investigations were initiated at Akron, Colorado, to monitor snowfall events, to estimate the contribution of snowmelt to crop production, and to design practical systems to trap and hold wind-transported snow for water conservation. For 24 winters, measurable snowfall occurred an average of 12 times per season, totaling 32 inches of cumulative snowfall, which contained 11.9% water and averaged 3.82 inches precipitation. Seasonal variations were sometimes extreme. Data are given for storm-size distribution, snowfall by months, snowfall during the nonfrozen soil period, and the characteristics of wind-transported snowfall. Sufficient snowfall and water intake of snowmelt from drifted snow occurs to justify developing snow management systems. Snow management systems tested involved the use of short-height woodslat fences of various air porosities, grass production leeward of snow fencing, snow retention by vegetative barriers of crop stubble and perennial tall wheatgrass, and snow retention by stripcropping. Snow deposition by windbreaks was also noted. Snowmelt storage efficiencies in soil generally exceeded 60%. The tall wheatgrass barrier system deposited snow onto crop target areas, significantly enhancing crop yields. This system should be adaptable to a large part of the Great Plains north of the 39 degrees latitude where average annual snowfall exceeds 28 inches. Better snow control for both agricultural and nonagricultural areas, such as highways, is warranted. (Moore-SRC)
W81-01941

BENEFITS OF DRAINAGE AND IRRIGATION A CLAYPAN SOIL,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
W. D. Goetsch, and P. N. Walker.
Paper No 79-2551 presented at 1979 Winter Meeting, American Society of Agricultural Engineers, December 11-14, 1979, New Orleans, LA, 4 p, 9 Fig, 1 Tab, 3 Ref. American Society of Agricultural Engineers, St. Joseph, Michigan. OWRT B-120-ILL(2).

Descriptors: *Clays, *Impervious soils, Hardpan, *Drainage practices, *Irrigation practices, *Corn(Field), *Crop response, Crop production, Expansive soils, Cohesive soils, Drainage systems, Drainage effects, Tiles, Irrigation water, Crop yield, Agriculture, Irrigation effects, Moisture availability, Vegetable crops, Illinois, Growth rates.

This 1977-1979 study sought to determine corn yield, as well as soil moisture, plant stress, and weather-related variables, as functions of drainage practice on both irrigated and non-irrigated claypan soils to facilitate increased understandings of drainage and irrigation and their effects on claypan soils. Twenty 18m x 32m plots, each having one of ten different combinations of irrigation and drainage treatments, were studied. Irrigated plots averaged 9.1 tonnes/hectare (tph); unirrigated plots, 7.1 tph. Drainage treatments showed that surface drainage plots, surface plus subsurface plots, subsurface drainage plots, and no drainage plots averaged 9.6, 10.6, 11.2, and 1.0 tph, respectively. Any of several methods used for monitoring soil moisture could be used to indicate when irrigation water application is warranted. Greatest differences were noted for 1979 (due to low precipitation for 1977 and 1978). The 1979 data will be used primarily to build models to predict corn yield form irrigation-drainage practices and weather trends. Prediction will allow cost-benefit determination for tile drainage/irrigation on southern Illinois claypan soils. (Zielinski-IPA)
W81-01944

PLANT AND CANOPY TEMPERATURES IN CORN AS INFLUENCED BY DIFFERENTIAL MOISTURE STRESS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
B. R. Gardner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173908, Price codes: A07 in paper copy, A01 in microfiche. Master of Science Thesis, Agricultural Meterology Progress Report 80-1, December, 1979. 119 p, 31 Fig, 10 Tab, 83 Ref, 2 Append. OWRT B-044-NEB(1).

Descriptors: *Engineering structures, *Corn(Field), *Crop response, *Temperature, *Moisture stress, *Canopy, Moisture availability, Air temperature, Soil temperature, Thermal stress, Cover crops, Irrigation practices, Irrigation water, Irrigation effects, Growth rates, Vegetable crops, Crops, Crop yield, Agriculture, Nebraska.

This study evaluated: temperature differences between stressed/non-stressed corn, optimum time-of-day to estimate maximum temperature difference, the effect of moisture stress on leaf and air temperature profiles within corn canopies, temperatures measured with an infrared thermometer versus leaf thermocouples, detectability of plant moisture status differences from minimum leaf temperatures, effectiveness of five crop temperature indices (to estimate phenological growth stage); and used canopy temperatures to estimate grain yield and seasonal water consumption in moisture stressed corn. Height differences between fully irrigated/non-irrigated plants was 50 centimeters. Average difference in mid-day canopy temperature between stressed/non-stressed areas was as large as seven degrees Centigrade. The possibility of using crop temperature measurements to evaluate effectiveness for various irrigation scheduling techniques is suggested. It was concluded that 1400 solar time was good for estimating T-max, the maximum temperature difference between stressed and non-stressed plants. The data suggested that crop temperatures can be used to assess the severity of moisture stress. (Zielinski-IPA)
W81-01948

STRATEGY FOR IRRIGATION DEVELOPMENT IN EGYPT UP TO THE YEAR 2000,
Ministry of Irrigation and Sudan Affairs, Cairo (Egypt).
E. M. A. Samaha, and M. Abu-Zeid.
Water Supply and Management, Vol 4, No 3, p 139-146, 1980.

Descriptors: Irrigation systems, *Reviews, *Nile River, Water rights, Flood plains, Deltas, Dams, *Irrigation practices, Future planning, Impoundments, Water demand, Crop production, Water resources development, Automation, Costs, *Projections, Irrigation efficiency, *Egypt.

A review of irrigation systems in Egypt from ancient times to the projected systems of the year 2000 is presented. The ancient civilizations depended upon the yearly flooding of the Nile basin to practice agriculture. To facilitate irrigation the Shadouf was employed to lift water to higher areas. This was later replaced by the water wheel, which was then mechanized by diesel or electric pumps. In the last ten years, irrigation has been rapidly expanded to meet the increasing populations of developing countries. In Egypt, the rate of development depends on technical and economic factors which are closely linked with the social habits and traditions of the nation. In view of this fact, it has been suggested that the development of irrigation in this country will proceed in three stages. The first stage involves improvement of control and distribution of irrigation water, which will take about five years to implement. Stage two concentrates on the development of field irrigation systems, which has been complicated by the number of small farms rather than larger geographical areas. The third stage will deal with the economics of irrigation development, with plans to charge each farmer for the amount of water actually used. It was projected that the second and third stages would be completed by the year 2000. It was proposed that an authority be set up to supervise affairs in field irrigation development. Recommendations were also made for national projects to take priority over field level improvements, as the latter would require more time and effort to implement. (Geiger-FRC)
W81-01950

CASE STUDY ON WATERLOGGING AND SALINITY PROBLEMS IN PAKISTAN,
National Engineering Services, Lahore (Pakistan).
S. M. H. Bokhari.
Water Supply and Management, Vol 4, No 3, p 171-192, 1980. 4 Tab, 12 Ref.

Descriptors: *Irrigation systems, *Pakistan, *Indus river, Water quality, Water resouces, Drainage wells, Water managemment, River basins, Land reclamation, Future planning, Saturated soils, *Irrigation practices, Salinity, Groundwater, Percolation, Social aspects, Waterlogging.

The gravity flow irrigation network of Pakistan is probably the largest on earth. It handles over 100 million acre-feet of water per year to supply an area of approximately 33 million acres. The Pakistan irrigation system is made up of 2 large dams, 20 small dams, 20 barrages and diversion weirs, over 90,000 farm outlets and 40,000 miles of irrigation channels. Many flood protection dikes and embankments and a network of surface drainage are featured in the gravity system. The system suffers from low economic output per unit of water diverted at the source due to a wide gap between supply and demand of irrigation water, excessive water losses in the system, inefficient irrigation, insufficient drainage, outmoded land and water management techniques, waterlogging and salinity, and greatly fragmented land holdings. To remedy the problems of salinity and waterlogging many projects have been undertaken, among them the Salinity Control and Reclamation Program. Socioeconomic factors add to the complexity of the problem in the face of increasing population, food deficits and the use of most of the water resources for primitive irrigation techniques. Several reclamation and groundwater projects have been undertaken, and the advice of foreign agencies has been examined to remedy the situation. Future courses of action that are planned for the Indus Basin are also discussed. (Geiger-FRC)
W81-01953

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

DETENTION LAKE APPLICATION IN MASTER DRAINAGE PLANNING,
Proctor and Redfern Ltd., Toronto (Ontario).
A. T. K. Fok, and S. H. Tan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173858, Price codes: A11 in paper copy, A01 in microfiche. In: Proceedings, Stormwater Management Model (SWMM) Users Group Meeting, 19-20 June, 1980, Toronto, Ontario, Environmental Protection Agency Report EPA 600/9-80-064, December, 1980, p 178-199. 9 Fig, 4 Tab, 2 Ref.

Descriptors: *Urban drainage, *Model studies, *Urban runoff, *Storm water, Storm runoff, Canada, Urbanization, Drainage systems, Cost analysis, Rainfall, Lakes, *Controlled drainage.

A stormwater drainage analysis carried out for the Edmonton Development area in Canada recommended the conversion of existing sloughs and depressions into a system of aesthetic urban lakes interconnected for controlled drainage. Computer models are used for simulating the various hydrologic conditions and testing the hydraulic responses within the system. The results of modelling are further used to optimize the number, size and layout of the proposed lake system with respect to

economics, design, hydraulic operation and development constraints. The best drainage alternative is the controlled release to the Kennedale Storm Sewer System with storage ponds. Based on rainfall data, the proposed 10.3 cm-day lake storage system is adequate for the whole 1700 ha Lake District. The optimum lake system is found to consist of three lakes in a balanced design, in which lake area and outflow rates are based on the respective tributary areas. Kidney shaped lakes are proposed with side slopes of 7:1 and surface areas of 1.6 and 2.0 ha at permanent water levels. During hydraulic simulation, no instability was found. (Moore-SRC)
W81-01930

ALTERNATIVE URBAN FLOOD RELIEF MEASURES; A CASE STUDY; CITY OF REGINA, SASKATCHEWAN, CANADA,
Theil (Paul) Associates Ltd., Brampton (Ontario).
A. M. Candaras.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173858, Price codes: A11 in paper copy, A01 in microfiche. In: Proceedings, Stormwater Management Model (SWMM) Users Group Meeting, 19-20 June, 1980, Toronto, Ontario, Environmental Protection Agency EPA 600/9-80-064, December, 1980, p 200-211. 1 Fig, 2 Tab.

Descriptors: *Urban drainage, *Storm runoff, *Model studies, *Drainage systems, Canada, Cost analysis, Floods, Urban runoff, Sewers, *Controlled drainage, *Regina(Saskatchewan).

The City of Regina, Canada, has been plagued by frequent flooding of basements and subways within the Seventh Avenue drainage area. The Hydrograph Volume Method was used for an analysis of the existing sewer system. The system was found to be heavily overloaded for storms of a 2-year return frequency. Considerable storm water overflows occurred to the sanitary trunk at common manholes. Roof water contributions were quickly overloading the existing sanitary sewer along local streets. A restriction in the storm water flow occurs at the outlet to the Wascana Creek, both by the limited capacity of the sewer and turbulence at the junction chamber. Alternative upgrading schemes were compared. Conventional solutions, regarding the replacement and addition of sewers, were the most costly and would result in greatest inconvenience and disturbance during the construction phase. Alternatives incorporating storage proved to be the most cost-effective. The total storage alternative requires no major upgrading to the existing sewer network. Downspout disconnection is by far the most cost-effective solution for the upgrading of the existing sanitary sewer. The recommended solution calls for the elimination of all common manholes and other interconnections, with storm outlet improvements to the Wascana Creek. (Moore-SRC)
W81-01931

ANALYSIS OF A CHANCE-CONSTRAINED RESERVOIR CONTROL MODEL,
IBM Watson Research Center, Yorktown Heights, NY.
M. Sniedovich.
Water Resources Research, Vol 16, No 5, p 849-853, October, 1980. 13 Ref.

Descriptors: *Model studies, *Eisel's equation, *Reservoir design, Design, Mathematical models, Flow, Planning, Storage capacity, Reservoir storage, Reservoir releases, *Reservoir operation.

Eisel's infinite reservoir model for estimating the distribution function of reservoir storage levels under a general linear release rule is shown to overestimate the tails of the distribution function, possibly leading to unduly conservative design and operation policies. This model does not perform well in the case of a finite reservoir. Its main problem is the positive errors introduced by the use of theoretical storage levels, ignoring shortage and overflow, and allowing storage levels to take values outside the constraints of the reservoir capacity. Several numerical examples are presented to support these observations. (Cassar-FRC)
W81-01959

RIVER MANAGEMENT IN THE URBAN ENVIRONMENT,
For primary bibliographic entry see Field 4C.
W81-02050

MATHEMATICAL MODEL FOR IMPROVING COMBINED SEWER SYSTEMS,
Public Works Research Inst., Ibaraki (Japan).
E. Nakamura.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 899-905, May, 1980. 11 Fig, 2 Tab, 2 Ref.

Descriptors: *Combined sewers, *Computer models, *Overflow, Runoff, Water pollution sources, Biochemical oxygen demand, Suspended solids, Chemical oxygen demand, Water storage, Japan, Hydrograph analysis, *Tokyo, Model studies.

A deterministic computer model of a combined sewer system was developed. Three pollutants were considered: 5-day 20C biochemical oxygen demand, suspended solids, and manganate chemical oxygen demand. A simulation run applied the model to a typical Tokyo community with an area of 542 ha. Hydrographs were generated using the Rippl method, and corresponding pollutographs were derived using equations in the model. Ten-year rainfall data were used. Using the model, temporary storage of the excess overflows was found to be the most effective method of reducing total discharged loads for the combined sewer system. Porous pavement was also effective for pollution control. The model program has an overflow subroutine and a treatment plant subroutine; thus the effect of any additional treatment at overflow points or at the treatment plant can be simulated. (Small-FRC)
W81-02104

DETENTION STORAGE FOR URBAN FLOOD CONTROL,
Espey Huston and Associates, Inc., Dallas, TX.
For primary bibliographic entry see Field 2E.
W81-02117

4B. Groundwater Management

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN SHERMAN COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
A. E. Bell, and S. Morrison.
Report 253, September, 1980. 64 p, 18 Tab, 75 Ref, 24 Maps.

Descriptors: *Texas, *Aquifers, *Groundwater potential, *Recharge, Water supply, *Water table, Irrigation, Storage depletion, Rainfall, Precipitation intensity, Hydraulics, Water wells, Data collections, Computer programs, Digital computers, Storage coefficient, Projections, *Ogallala aquifer(TX), *Sherman County(TX).

To provide information concerning the water shortage problems in the High Plains of Texas, high-speed computers were used to conduct evaluation and projection studies of groundwater resources. Historical pumpage has been approximately eleven times the rate of natural recharge. Sherman County's total annual agricultural income of $65 million is dependent on fresh groundwater supplied by the Ogallala aquifer. Severe overdrafts threaten to deplete the aquifer to the point that it may not be economically feasible to produce water for irrigation. Water-use patterns between 1960 and 1972 were used to develop an aquifer depletion schedule. To estimate the volume of water in storage in the aquifer, an electronic digital computer constructed maps reflecting the saturated thickness of the aquifer. A computer program also calculated future saturated thickness at individual well sites. Estimates of current pumpage were obtained as were estimates of the Ogallala's well-yield. The report uses maps, charts, and tabulations to make reasonable projections about the future conditions of the Ogallala aquifer. (Garrison-Omniplan)
W81-02000

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN MOORE COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
A. E. Bell, and S. Morrison.
Report 252, August, 1980. 64 p, 18 Tab, 77 Ref, 24 Maps.

Descriptors: *Texas, *Aquifers, *Groundwater potential, *Water supply, *Recharge, *Water table, Irrigation, Computer programs, Storage coefficient, Precipitation intensity, Hydraulics, Water wells, Data collections, Rainfall, Storage depletion, *Ogallala aquifer(TX), *Moore County(TX).

This is one in a series of planned and executed county studies to alert water users and government officials to the declining groundwater resources of the Ogallala aquifer in the High Plains of Texas. Historical pumpage has exceeded 200,000 acre-feet annually, which is approximately ten times the rate of natural recharge to the aquifer in the county. Groundwater is extremely important to the county's economy, as most of the crops are irrigated with groundwater. The report contains maps, charts and tabulations which reflect estimates of the volume of water in storage in the aquifer in Moore County and the projected depletion of this supply by decade periods through the year 2020. Observations were made from existing water level wells by examining water-use patterns between 1960 and 1972. An electronic digital computer was used to construct maps which reflect the saturated thickness of the aquifer for those years, and a computer program was written to calculate future saturated thickness at individual well sites. Another purpose was to predict future overdraft consequences. However, a variety of economic and meteorological uncertainties limit these predictions to a reasonable set of general expectations. Conservation practices would additionally affect these projections. It is hoped that this study will help persuade water users to implement all possible conservation measures. (Garrison-Omniplan)
W81-02001

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN ARMSTRONG COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
A. E. Bell, and S. Morrison.
Report 251, August, 1980. 64 p, 18 Tab, 76 Ref, 24 Maps.

Descriptors: *Texas, *Aquifers, *Groundwater potential, *Recharge, *Water table, Rainfall, Precipitation intensity, Irrigation, Storage coefficient, Hydraulics, Water wells, Data collections, Computer programs, Digital computers, Water supply, *Ogallala aquifer, *Armstrong County(TX).

The principal source of fresh groundwater in Armstrong County is the Ogallala aquifer; however, the withdrawl of groundwater during the past three decades has been approximately two and one-half times the rate of natural recharge. If this overdraft continues, the aquifer will be depleted to the point that it may not be economically feasible to produce water to irrigate Armstrong County's crops, which yield a total annual farm income exceeding $14 million. This study was conducted to find ways to inform water users, via maps, charts and tabulation, of the groundwater depletion, and to provide information to local, state and federal officials to use in implementing plans to alleviate the water shortage problem in the High Plains of Texas. Records from existing water level

bservation wells provided the study's principal lata base, which included: (1) measurements of the lepth to water below land surface; (2) the dates hese measurements were made; and (3) the depth rom land surface to the base of the Ogallala quifer. High-speed computers were used for auto-natic data processing. Uncertainties exist about uture overdrafts related to various price and lemand factors. (Garrison-Omniplan)
W81-02002

OCCURRENCE AND QUALITY OF GROUND-WATER IN THE EDWARDS-TRINITY (PLA-TEAU) AQUIFER IN THE TRANS-PECOS REGION OF TEXAS,
Texas Dept. of Water Resources, Austin.
R. Rees, and A. W. Buckner.
Report 255, September, 1980. 41 p, 9 Fig, 3 Tab, 61 Ref.

Descriptors: *Texas, *Aquifers, Groundwater availability, Water supply, Water table, *Recharge, *Irrigation, Discharge measurement, Water wells, Hydraulics, Storage depletion, *Water quality, Data collections, Computer programs, *Trans-Pecos Region(TX).

With the development of large-scale irrigation, discharge from the Edwards-Trinity aquifer has exceeded recharge in most of the irrigation areas and water has been withdrawn from storage. This study surveys information since 1973, including available geologic and hydrologic data, subsurface data, water levels in wells and chemical composition of water in wells to assess groundwater use and quality. Long-term water level declines were found to be most pronounced in the central Reeves County irrigation area, in the north and south Coyanosa, and in the Fort Stockton-Leon-Belding irrigation areas of Pecos County. This decline in water levels has caused Comanche Springs and Leon Springs to stop flowing. In those parts of the aquifer that have not been developed for irrigation, such as in Terrell and southern Pecos Counties, the recharge and discharge have remained almost in equilibrium and the aquifer contributes flow to the Rio Grande and the Pecos River through seeps and springs. The quality of water within the aquifer was found to vary from less than 500 to more than 5,000 milligrams per liter of dissolved solids. It is recommended that monitoring programs be updated regularly to ensure long-term water quality and supply. (Garrison-Omniplan)
W81-02003

RECORDS OF WELLS, WATER LEVELS, PUMPAGE, AND CHEMICAL ANALYSES OF WATER FROM THE CARRIZO AQUIFER IN THE WINTER GARDEN AREA, TEXAS, 1970 THROUGH 1977,
Texas Dept. of Water Resources, Austin.
G. R. Elder, G. L. Duffin, and E. Rodriguez, Jr.
Report 254, September, 1980. 125 p, 4 Tab, 6 Ref, 6 Maps.

Descriptors: *Texas, *Aquifers, Water wells, water table, *Water levels, Water supply *Chemical analysis, Irrigation, Groundwater, *Water quality, Storage depletion, Utilities, Hydraulics, Data collections, Computer programs, Digital computers, *Carrizo aquifer(TX), Winter Garden area(TX).

Groundwater pumpage, water levels and chemical quality of groundwater in the Carrizo aquifer were examined by studying wells in seventeen counties in this area. The objectives of the study were to update records in groundwater pumpage and water level monitoring programs for refinement of the digital computer model and to continue monitoring water quality. Most of the water pumped from the Carrizo aquifer is used for irrigation. In 1970 the largest quantity used for irrigation was in Zavala County, while in 1971-1975 it was in Frio County. Water levels declined about 320 feet in Zavala County from 1929-1930 to 1976, while for the same period, water levels rose in Dimmit County in most of its central and eastern parts. There have been no significant changes in groundwater quality except on a local basis, such as leaks in the casing, which were remedied. In addition to mailed questionnaire responses, irrigation pumpage was determined by: (1) obtaining data from utilities regarding cubic feet of natural gas and kilowatt-hours of elctricity supplied to irrigatd farms; (2) conducting power and yield tests on selected irrigation wells; and (3) multiplying the average number of gallons produced per cubic foot and kilowatt-hours by total amount supplied by the utilities. (Garrison-Omniplan)
W81-02004

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN RANDALL COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
A. E. Bell, and S. Morrison.
Report 250, July 1980. 64 p, 18 Tab, 24 Maps.

Descriptors: *Texas, *Aquifers, *Groundwater-recharge, *Water table, Irrigation, Storage coefficient, Rainfall, Precipitation intensity, Hydraulics, Water wells, Data collections, Computer programs, Digital computers, Storage depletion, Porosity, Pumping, Drawdown, Water levels, *Ogallala aquifer(TX), *Randall County(TX).

One of a series of studies covering the declining groundwater resources of this aquifer in the High Plains of Texas. It is hoped this report will help local, State and Federal officials implement plans to alleviate the water shortage in this area. Historical pumpage in Randall County, which has numerous agribusinesses, has been about four times the rate of natural recharge to the aquifer. The principal source of fresh groundwater is the Ogallala aquifer. In Randall County, the Ogallala receives natural recharge from local precipitation and from adjoining areas; however, obtaining a reliable recharge rate is complicated by many factors. The Texas Department of Natural Resources maintains water level observation wells which provided the principal data base used in this study. Water-use patterns between 1960 and 1972 were used to develop an aquifer depletion schedule. Using these data, a computer program was written to calculate future saturated thickness at individual well sites. To estimate the volume of water in storage in the aquifer, an electronic digital computer was used to construct maps which reflect the saturated thickness of the aquifer. Estimates of current pumpage were also obtained. In calculating pumping lifts, procedures similar to those used to estimate volume of water in storage and pumpage were employed, also using the computer and the original data base. Estimates of the Ogallala's well-yield are presented, but are subject to localized geological conditions. Using maps, charts and tabulations, this report makes reasonable projections but not absolute predictions about the depletion of the Ogallala aquifer. (Atkins-Omniplan)
W81-02005

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN SWISHER COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
A. E. Bell, and S. Morrison.
Report 249, July 1980. 64 p, 18 Tab, 24 Maps.

Descriptors: *Texas, *Aquifers, *Groundwater-recharge, *Water table, Irrigation, Storage coefficient, Rainfall, Precipitation intensity, Hydraulics, Water wells, Data collections, Computer programs, Digital computers, Storage depletion, Drawdown, Water levels, *Ogallala aquifer(TX), *Swisher County(TX).

During the past three decades, the withdrawal of groundwater has greatly exceeded the natural recharge to this aquifer. If this continues, there will be reduced well yields and it may not be economically feasible to produce water for irrigation. Swisher County is a leading producer of agricultural crops in the State, most of which are irrigated with groundwater. Because the Southern High Plains area is hydraulically independent of adjacent areas and has little local rainfall, water withdrawn from the aquifer is not quickly replaced by natural recharge. Changes in soil and land surface accompanying large-scale irrigation may have positively affected the recharge from precipitation; however, reliable estimates are difficult to obtain because of factors such as irrigation recirculation. Water-use patterns between 1960 and 1972, determined by water level wells, were used to develop an aquifer depletion schedule. A computer was used to construct maps reflecting the saturated thickness of the aquifer for these same years, as well as to estimate volume of water in storage and to determine pumping lift. Estimates of future well-yield are projected, but these projections will be influenced by many factors. This study uses maps, charts and tabulations in an effort to persuade water users to implement all possible conservation measures so that the remaining groundwater is used most prudently. (Atkins-Omniplan)
W81-02006

LAND-SURFACE SUBSIDENCE IN THE TEXAS COASTAL REGION,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02031

WATER-SUPPLY ASSESSMENT OF THE LARAMIE-FOX HILLS AQUIFER IN PARTS OF ADAMS, BOULDER, JEFFERSON, AND WELD COUNTIES, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
P. A. Schneider, Jr.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $13.50 in paper copy, $6.50 in microfiche. Geological Survey Open-File Report 80-327 (WRI), 1980. 17 p, 2 Fig, 6 Plates, 2 Tab, 12 Ref.

Descriptors: *Water supply, *Groundwater, *Water quality, *Available water, *Colorado, Potential water supply, Aquifers, Water resources development, Water utilization, Confined water, Recharge, Groundwater movement, Water wells, Potentiometric level, Water levels, Pumping, Drawdown, Aquifer characteristics, Water storage, Chemical analysis, *Laramie-Fox Hills aquifer, Coal Creek Basin(CO).

Groundwater in the Laramie-Fox Hills aquifer is a potential source of supplemental municipal water supplies for the communities of Erie, Lafayette, Louisville, and Superior in Colorado. The present water supplies for these communities are not always adequate to meet current demands. The U.S. Geological Survey made a water-supply assessment of the Laramie-Fox Hills aquifer for the U.S. Bureau of Reclamation, which is investigating and evaluating alternative sources of water for the communities. Recharge to the aquifer is mostly in the western and southwestern parts of the study area. Groundwater movement is generally from the southwest to northeast. Groundwater discharge in the study area is primarily by pumping wells. Since 1961, this pumping has caused water-level declines of about 250 to 300 feet from Broomfield to east of Erie, Colorado. Generally, water levels in other parts of the area have remained the same. The aggregate sand thickness determined from well logs ranges from 42 to 360 feet and the mean thickness is 229 feet. The volume of groundwater in storage in the study area is about 5 million acre-feet. Reported yields from 93 wells ranged from 1 to 90 gallons per minute and averaged 22 gallons per minute. Well yields tended to be larger in the areas where aggregate sand thickness is the greatest. The water generally changes from a sodium calcium bicarbonate type to a sodium calcium sulfate type as it moves through the aquifer away from the recharge areas. The maximum limit established by the U.S. Environmental Protection Agency for nitrite plus nitrate in public-water supplies was exceeded in water from three wells, the maximum limit for fluoride was exceeded in water from two wells, and the maximum limit for selenium was exceeded in water from three wells. (USGS)

W81-02033

COMPARISON OF SPRINKLER UNIFORMITY MODELS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
R. L. Elliott, J. D. Nelson, J. C. Loftis, and W. E. Hart.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 106, No IR4, p 321-330, December, 1980. 2 Fig, 16 Ref.

Descriptors: Statistical methods, *Statistical models, *Sprinkler irrigation, Wetting, *Irrigation systems, Uniformity coefficient, Goodness-of-fit, Model studies.

This study adapted the beta distribution for the characterization of water application depths of sprinkler irrigation systems, and evaluated the goodness of fit of the linear, normal, and beta models to water application depths. Also, recommendations were developed for selecting the appropriate statistical distribution to be used in a specific situation. Linear, normal, and beta statistical models were fitted to 2450 overlapped sprinkler irrigation patterns. The deviations of the three models from the observed water distribution were compared. The beta distribution provided the best fit, but is the least practical to use. The normal model generally fit observed sprinkler distributions better than the linear model at uniformity coefficients above about 0.65. At lower uniformities, the opposite was true. If tables or equations were developed for the ready determination of irrigation performance parameters from the beta distribution, this greater accuracy could encourage its use. At present the normal model is recommended. (Small-FRC)
W81-02081

MODELING SUPPLEMENTAL IRRIGATION WATER DEMAND,
Tetra Tech Inc., Lafayette, CA.
J. D. Dean.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 106, No IR4, p 285-297, December, 1980.

Descriptors: *Mathematical models, *Irrigation water, *Water demand, *Supplemental irrigation, Meteorological data, Crops, Soil physical properties, Simulations.

A deterministic hydrology model, ARM-II, was modified to simulate the application to supplemental irrigation water demand. The model was modified to simulate a three-layer soil instead of a two-layer soil, because the additional layer adds the flexibility of more closely defining crop rooting depths and conceptually defines water requirements more accurately. Also, an irrigation submodel was added. Stochastic climatological models can be used alone if meteorological data covering sufficient lengths of time is available. Irrigation water demands for a corn crop grown on Cecil sandy loam soil at Watkinsville, Georgia, were simulated for two 50-year management practices. The two practices were: irrigating when soil matrix potential rose above 0.06 bar, and irrigating when soil matrix potential rose above 15 bar. The first practice required substantially more water than the second. The model can be used to investigate irrigation water demand under different climate, crop, and soil conditions. (Small-FRC)
W81-02082

4C. Effects On Water Of Man's Non-Water Activities

RIVER MANAGEMENT IN THE URBAN ENVIRONMENT,
R. D. Beaumont.
Municipal Engineer (Johannesburg), Vol 10, No 4, p 43-45, July/August, 1979.

Descriptors: *Urbanization, *River systems, *Urban runoff, *Flood plains, River flow, Flood control, Legislation, Building codes, Erosion rates, Scour, Channels, Stream erosion, Infiltration, Storm runoff, *Water management.

Growing urbanization threatens the natural stability of a river system by increasing the proportion of storm run-off and by increasing the intensity of flood discharge. As roads and buildings replace soil and vegetation, a relatively constant degree of permeability is reached causing increased runoff from even typical storms. This runoff requires a larger channel for its conveyance, leading to accelerated erosion of river beds and banks. Urbanization can also reduce dry weather flows and reduce groundwater amounts. This can adversely affect the stabilizing vegetation along a river. With erosion and weakened roots, small trees can be uprooted during heavy flows and carried downstream until they catch and restrict flows, causing even more damage from flooding. Urbanization has also resulted in extensive building on floodplains. Recent legislation has acknowledged the problems of rivers and urbanization but has done little to help. New attitudes and values are beginning to take hold and this should result in progress toward making urbanization less damaging to river systems. (Seigler-IPA)
W81-02050

CHALLENGING COMBINED SEWER PROBLEMS IN JAPAN,
Ministry of Construction, Ibaraki (Japan). Water Quality Control Dept.
M. Kuribayashi, and E. Nakamura.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 890-898, May, 1980. 7 Fig, 3 Tab, 2 Ref.

Descriptors: *Combined sewers, *Urban runoff, *Overflow, Control, Water pollution sources, Treatment facilities, Performance, Interception, Conveyance structures, Cities, Water quality, Japan.

Research carried out by the Japanese Public Works Research Institute to solve combined sewer problems is reviewed, and some examples of control measures taken by municipal governments are presented. Urban runoff management systems have been under study since 1967. Because the population density of Japanese cities is relatively high when compared with other countries, combined sewer overflow releases more untreated waste water into receiving waters. Also, supernatants from sludge handling facilities are often returned periodically to grit chambers or primary settlers. If supernatants are returned when there is discharge of primary effluent, the quality of the discharged effluent is sometimes poorer than that of plant influent. Possible control methods being studied include swirl concentrator/regulator facilities and stormwater sedimentation basins. Interceptor enlargement, upstream detention, downstream detention, and new trunk sewers are methods being tried by various municipalities. Interceptor enlargement is the most widely applied solution. (Small-FRC)
W81-02103

POLITICAL ASPECTS OF URBAN STORMWATER MANAGEMENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
For primary bibliographic entry see Field 2E.
W81-02118

4D. Watershed Protection

SOIL EROSION BY WATER AS RELATED TO MANAGEMENT OF TILLAGE AND SURFACE RESIDUES, TERRACING, AND CONTOURING IN EASTERN OREGON,
Science and Education Administration, Pendleton, OR. Columbia Plateau Conservation Research Center.
R. R. Allmaras, S. C. Gupta, J. L. Pikul, Jr., and C. E. Johnson.
Science and Education Administration, Oakland, California, Agricultural Research Results Report ARR-W-10, February, 1980. 57 p, 9 Fig, 25 Tab, 35 Ref, 1 Append.

Descriptors: Cultivation, *Terracing, *Contour farming, *Erosion control, *Soil management, Oregon, Land forming, *Soil erosion, Wheat, Legumes, Field crops, Slopes, Runoff, Bioenergy harvest.

Soil erosion by water was estimated for combinations of three management types in the B7, B8, and B9 Major Land Resources Areas of eastern Oregon. The three management types were tillage and residue handling, terracing, and contouring. The Universal Soil Loss Equation was applied along with detailed factor information used in conservation planning. Wheat-fallow and wheat-pea sequences predominate on the tilled cropland, which constitutes about 43% of the land area. Potential soil erosion in the three Major Land Resource Areas not only differed because of differences in the rainfall and runoff energy factor, but also because of major differences in soil tolerance for soil erosion and percentage of steeper slopes. Slope steepness was the primary factor determining which combination of the three management types was needed. Soil erosion could not be held below tolerance values in the wheat-fallow sequence for slopes exceeding 20%; a combination of all three types was needed for slopes between 12 and 20%; tillage and residue handling along with contour operation sufficed on slopes of less than 12%. On slopes of less than 5%, none of the control measures was needed. The wheat-pea sequence allowed no relaxation of control measures. Erosion control measures affected the amount of residue available for bioenergy harvest; for the test area, as a whole, 50 to 70% of the residue produced is available for harvest; the proportion of harvested area from which residues can be taken ranges from 98 to 62% of harvested area. (Moore-SRC)
W81-01940

SEDIMENT LOSSES FROM SMALL AGRICULTURAL WATERSHEDS IN HAWAII (1972-77),
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
S. A. El-Swaify, and K. R. Cooley.
Science and Education Administration, Oakland, California, Agricultural Reviews and Manuals ARM-W-17, September, 1980. 128 p, 5 Fig, 5 Tab, 26 Ref. Available from U.S. Water Conservation Laboratory, Phoenix, Arizona.

Descriptors: *Hawaii, *Soil erosion, *Agricultural watersheds, *Sugar cane, *Pineapples, Storm runoff, Sediment transport, Tropic regions, Erosion control, Roads, Rainfall intensity, Slopes, Small watersheds, Farm management.

In Hawaii, and the humid tropics in general, the magnitudes of soil loss by water erosion are acknowledged to be drastically higher than in temperate regions, but data to confirm this generalization are scarce. Results from studies on two pineapple and four sugarcane fields in Hawaii showed soil losses to be below recommended annual tolerance limits recognized by the Soil Conservation Service. If these fields are representative, this would indicate that: present farming practices are adequate to control erosion, only very large, rare events are responsible for the majority of the erosion, or sediment sources in Hawaii are rarely agricultural in origin. Analyses of storm characteristics showed that over 90% of the storms recorded at the six different locations were of the Type IA and I distribution as defined by the Soil Conservation Service. These types of storms are characterized by low intensity rainfall and are not conducive to high erosion potential. Both pineapple and sugarcane provided considerable protection only a few months after planting. On watersheds with less than 5% of the area in roads, almost all erosion occurred during, or shortly after, harvest and field preparation. On fields with greater than 5% of the area in roads, erosion occurred during almost all significant storm events, and annual erosion rates approached tolerance limits when 20% of the field was in roads. Although erosion was

observed on the steeper areas, much of the sediment was deposited on lower flat portions of the field before reaching the delivery points at which sediment sampling equipment was installed. (Moore-SRC)
W81-01943

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

THE QUANTITATIVE AND QUALITATIVE ANALYSIS OF THE WATER SOLUBLE FRACTION OF JET FUELS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
S. A. Klein, and D. Jenkins.
Water Research, Vol 15, No 1, p 75-82, January, 1981. 6 Fig, 2 Tab, 2 Ref.

Descriptors: *Separation techniques, *Fuels, *Pollutant identification, Analytical techniques, Gas chromatography, Water analysis, Chemical wastes, Water pollution, Chemical analysis, Volatility, Organic compounds, Aqueous solutions, *Jet fuels, Hydrocarbons, Solubility.

Methods for the qualitative and quantitative analysis of water soluble fractions (WSF) of hydrocarbon jet fuels that are common pollutants of aquatic systems are presented. Depending on the volatility of the WSF components, a purge-and-trap or pentane extraction technique may be used for concentration of the pollutants. In quantitative analysis, the recovery need not be 100% as long as high reproducibility can be achieved. In the qualitative detection of the WSF of hydrocarbon jet fuels, full and reproducible recovery of all components is desired. After the WSF components in the raw water samples are concentrated, gas chromatography is carried out. For WSF of JP-4 fuel, quantitation is best achieved by purge-and-trap concentration, followed by temperature programmed gas chromatography, while for Shale JP-9, pentane extraction must be used. Qualitative analysis of JP-4 and JP-8 is best accomplished by the purge-and-trap method to avoid evaporation of components and masking of peaks by the pentane solvent. Shale JP-8, however, does not give good results when subjected to qualitative analysis by the purge-and-trap procedure, due to the small amount of volatile components in this fuel. (Geiger-FRC)
W81-01980

DETERMINATION OF HYDROLYTIC ACTIVITIES IN WASTE WATER SYSTEMS BY MICROCALORIMETRY,
Innsbruck Univ. (Austria). Hygienisches Inst.
For primary bibliographic entry see Field 5D.
W81-01984

CONCENTRATIONS OF RADIONUCLIDES IN LAKE ONTARIO WATER FROM MEASUREMENTS ON WATER TREATMENT PLANT SLUDGES,
Canada Centre for Inland Waters, Burlington (Ontario).
R. W. Durham, and S. R. Joshi.
Water Research, Vol 15, No 1, p 83-86, January, 1981. 2 Fig, 3 Tab, 5 Ref.

Descriptors: *Fallout, *Radioisotopes, *Pollutant identification, Sludge, Water treatment, Lake Ontario, Analytical techniques, Water pollution, Water pollution sources, Lakes, Equations, Spectrophotometry, X-ray fluorescence.

Analyses of aluminum hydroxide sludge for the calculation of radionuclides in the untreated raw water were compared with direct gammaspectral measurements of radionculides in lake water. Sludges from four plants which treated water from Lake Ontario were processed by two different methods. In the first, dried sludge samples were extracted with HCl, and aluminum levels were determined by atomic absorption spectrometry. In the second method, pelletized dried sludge was analyzed by x-ray fluorescence using a scanning electron microscope beam. Equations were applied to describe relationships between the concentration of radionuclides in raw lake water and the volume of lake water treated per kg of dried sludge. Results showed reasonably good agreement between direct and indirect methods of determining Cs137 and Ra226 in Lake Ontario water. Better agreement between results is expected when the rate of alum addition at the water treatment plant is precisely known. All the radionuclides identified at the four plants were traced to fallout from atomic weapons testing, with the exception of the naturally-occurring Be7, Ra228, and Th228. The method may not be reliable for the quantification of shorter-lived radionuclides due to the long residence times of the sludges in the settling basins. (Geiger-FRC)
W81-01985

AN AUTOMATED METHOD FOR THE DETERMINATION OF NON-IONIC SURFACTANTS IN WATER,
Water Pollution Research Lab., Stevenage (England).
K. W. Petts, and I. Sliney.
Water Research, Vol 15, No 1, p 129-132, January, 1981. 3 Fig, 4 Ref.

Descriptors: *Surfactants, *Colorimetry, Automation, *Pollutant identification, Analytical techniques, Biodegradation, Separation techniques, Water analysis.

An automated technique for the detection of non-ionic surfactants in water is described. A modified AutoAnalyzer system was used in the colorimetric analysis, which is based on the reaction of ammonium cobaltothiocyanate with the surfactants to produce a colored complex. The complex is extracted into chloroform, and its concentration is measured at 620 nanometers. The detection limit was about 0.5 milligrams/liter, with a standard deviation of 0.2 milligrams/liter at the 10 milligrams/liter level. Approximately 3 samples/hour may be analyzed by the automated system; operation overnight without attendance has proven feasible. The large aqueous-to-solvent ratio (about 25:1) needed to obtain adequate sensitivity of response to the smaller concentrations of non-ionic surfactants presents problems in maintaining the proper flow through the small bore acidflex pump tubes. However, the method may be considered suitable for biodegradability studies of ethoxylate materials and forms the basis for further research in this area. (Geiger-FRC)
W81-01987

SPECIES OF DISSOLVED METALS DERIVED FROM OLIGOTROPHIC HARD WATER,
Bayerische Landesamt fuer Wasserwirtschaft, Munich (Germany, F. R.).
C. Steinberg.
Water Research, Vol 14, No 9, p 1239-1250, September, 1980. 9 Fig, 2 Tab, 47 Ref.

Descriptors: *Metals, *Chelation, *Water pollution, Organic matter, Solutes, *Hardness(Water), Natural streams, *Pollutant identification, Germany, Lake Walchensee(West Germany).

Water samples were taken from a small mountain creek, Altlach, which traverses spruce and beech forests on dolomite underground in Upper Bavaria, Lake Walchensee, Germany. Trace metals and alkaline earth metals were determined by atomic absorption spectrometry. Sodium and potassium were determined by flame spectrometry. Multistage gel chromatography was used to fractionate dissolved organic carbon and associated metals including Na, K, Mg, Ca, Al, Fe, Mn, Ni, Cr, Cu, Pb, Cd, and Zn, according to their molecular sizes. All the metals were shown to be present to a measurable degree in chelated form. Of the total concentration of lead found, 97.3% of it was in chelated form. Corresponding figures for Al and Cr were 91.5 and 82.2%, respectively. In each case the metals were chelated with Fe. About 69% of all the metal chelates were represented by Mg compounds. Specific distribution patterns were identified for Pb and Mn. Pb is preferably chelated by macromolecular substances, Mn by micro ones. Cr seems to behave similarly to Pb. (Baker-FRC)
W81-01989

MOUNT ST. HELENS ASH FALL IN THE BULL RUN WATERSHED, OREGON, MAY-JUNE 1980,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-02036

HYDROLOGY OF THE SELDOVIA AREA, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02037

WATER QUALITY IN RHODE RIVER AT SMITHSONIAN INSTITUTION PIER NEAR ANNAPOLIS, MARYLAND, JANUARY 1976 THROUGH DECEMBER 1978,
Geological Survey, Edgewater, MD. Water Resources Div.
R. L. Cory, and P. V. Dresler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-220809, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-109, January, 1980. 53 p, 7 Fig, 1 Tab.

Descriptors: *Water quality, *Rivers, *Maryland, *Estuaries, *Water properties, Chemical analysis, Water temperature, Salinity, Turbidity, Dissolved oxygen, Hydrogen ion concentration, Water levels, Tidal effects, *Rhode River estuary(MD).

Water temperature, salinity, turbidity, dissolved oxygen, pH, and water level data were continuously monitored and recorded from the Smithsonian Institution pier near Annapolis, Md., from January 1976 through December 1978. Daily maximum and minimum values are tabulated and summarized, and monthly averages and extremes are presented. Water temperature ranged from 0.0 to 33.9 Celsius. Both high and low extreme values exceeded those recorded during the previous 6 years. Salinity patterns showed normal seasonal variations and were related to the Susquehanna River inflow, which controls the upper bay salinity. Salinity between 13 and 15 parts per thousand in November and December 1978 were the highest recorded over a 9-year period. Turbidity varied seasonally, with lowest values in winter and highest in spring. Dissolved oxygen ranged from 2.0 to 18.7 milligrams per liter. Large variations between summertime daily minima and maxima indicated the high state of eutrophication of the water being monitored. Hydrogen-ion activity (pH) ranged from 7.0 to 10.2 over the 3-year period. The pH changes reflect daily variation in partial pressure of carbon dioxide, which varies inversely with the dissolved oxygen. Water level variation at the monitoring site for the 3-year period was 1.89 meters, with highest water 0.59 meter above mean high water and lowest 0.83 meter below mean low water. An apparent decline of 0.07 meter below previously recorded mean high and mean low water was associated with stronger winds and a prevalance of westerly winds in February during the winter of 1976-1977. (USGS)
W81-02040

A PRELIMINARY ANALYSIS OF BACTERIAL NUMBERS AND BIOMASS IN LANGEBAAN LAGOON,
Cape Town Univ. (South Africa). Dept. of Zoology.
H. G. F. Mazure, and G. M. Branch.
Transactions of the Royal Society of South Africa, Vol 44, No 1, p 43-54, June, 1979. 5 Fig, 2 Tab, 23 Ref.

Descriptors: *South Africa, *Langebaan Lagoon, *Biomass, *Bacteria, *Sediments, Marine microor-

ganisms, Marine bacteria, Suspended solids, Seasonal, Water analysis, Aquatic microbiology, Benthic fauna, Saline water, Mud, Intertidal areas, Organic matter.

The epifluorescent indirect count method was used to analyze the bacterial numbers and biomass of the water and sediments of Langebaan lagoon, a lagoon of marine origin with no riverine input located on the west coast of South Africa. Bacteriological samples and particle samples were taken at high tide at seven different sites, while intertidal sediment samples were taken at six sites. During microscopic examination the bacteria were divided into long rods and small coccal forms, and the average size was measured for each category in a sample. Results show a decline in bacterial numbers paralleled by a decline in suspended particles from Saldanha Bay to the head of Langebaan lagoon. This correlation indicates that organic particles provide a limiting substrate for the bacteria. Bacterial biomass and zooplankton biomass are found to be comparable. Bacterial numbers and biomass in the sediments increased progressively towards the south end of the lagoon accompanied by a decrease in particle size and an increase in percentage mud and percentage organic material. The range of bacterial biomass was from 16 to 232 mg/kg of wet sediment for a mean of approximately 14.2 g/m sq, which was comparable to the biomass of benthic macrofauna. (Seigler-IPA)
W81-02055

USE OF EQUIVALENT BOD AS A NEW WASTE MANAGEMENT TOOL,
Kraft, Inc., Glenview, IL.
H. I. Goldsmith, and K. S. Watson.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 372-380, February, 1980. 1 Fig, 7 Tab, 13 Ref.

Descriptors: *Industrial wastes, *Dairy industry, *Food processing industry, *Biological oxygen demand, *Pollutant identification, Waste water treatment, Waste identification, Milk, Proteins, Carbohydrates, Computers, Organic wastes, Least squares method.

Using least-squares fitting of literature data, an equation to calculate equivalent biochemical oxygen demand (EBOD) was developed for food products. Although this formula is designed primarily for dairy products, it is applicable to other foods as long as the percentages of protein, fat, and carbohydrate are known. The relationship may be expressed as: EBOD = 1.031 (protein) + 0.891 (fat) + 0.691 (carbohydrate). Laboratory-determined BOD values and calculated EBOD values showed good agreement for various milk products. This tool permits improved waste management in the food industry, relating EBOD to the load found in the plant's effluent and allowing identification of wasteful operations. Use of computer technology makes it possible to apply this approach to multi-product plants. (Cassar-FRC)
W81-02088

GAS-CHROMATOGRAPHIC/MASS-SPECTROMETRIC ANALYSIS OF DERIVATIZED AMINO ACIDS IN MUNICIPAL WASTE WATER PRODUCTS,
North Texas State Univ., Denton. Dept. of Chemistry.
J. L. Burleson, G. R. Peyton, and W. H. Glaze.
Environmental Science & Technology, Vol 14, No 11, p 1354-1359, November, 1980. 6 Fig, 4 Tab, 33 Ref.

Descriptors: *Amino acids, *Chlorination, *Waste water, *Municipal wastes, Analytical techniques, Chromatography, Nitrogen compounds, Pollutant identification, Chemical reactions.

Twenty common amino acids in municipal waste waters were determined by gas chromatography/mass spectrometry after cation-ligand exchange and derivatization to N(O)-heptafluorobutyrylisoamyl and N(O)-heptafluorobutyryl-n-propyl esters. Recoveries ranged from 69% for glutamic acid and 80-89% for alanine, tyrosine, tryptophan, ornithine, aspartic acid, and arginine to greater than 90% for glycine, valine, threonine, serine, leucine, isoleucine, proline, cysteine, hydroxyproline, methionine, histidine, phenylalanine, and lysine. Several amino acids were chlorinated with hypochlorous acid and some reaction products characterized. Some unusual derivatives were chlorotyrosine, dichlorotyrosine, and oxindole derivatives of tryptophan. A comparison of the method used in this paper and the Beckman 120-C amino acid analyzer showed good agreement. Differences ranged from 1.4 to 48.8%. Some disagreements were shown in the determinations of cysteine, hydroxyproline, and histidine. Waste water samples, some chlorinated, from 4 cities were analyzed for free amino acids. Superchlorination of effluents effectively destroyed the amino acids. The presence of chlorotyrosine and dichlorotyrosine was confirmed. Since the toxicities of chlorinated amino acids have not been reported, further work on this subject is needed. (Cassar-FRC)
W81-02128

RELATIONSHIP OF VIRUSES AND INDICATOR BACTERIA IN WATER AND WASTE WATER OF ISRAEL,
Ministry of Health, Tel-Aviv (Israel). Central Virus Lab.
Y. Marzouk, S. M. Goyal, and C. P. Gerba.
Water Research, Vol 14, No 11, p 1585-1590, November, 1980. 5 Tab, 33 Ref.

Descriptors: *Viruses, *Bioindicators, *Pollutant identification, Water pollution sources, Microorganisms, Indicators, Quality control, *Israel.

Extensive monitoring of aquatic resources of Israel was undertaken to provide background data on the occurrence of enteroviruses and to determine how adequately bacteriological indicators were reflecting their presence. Samples of groundwater (99), potable water (23), sewage and grossly polluted surface water (19), surface water (8), and swimming pool water (6) were examined, making a total of 155 samples. Echovirus type 7 was the predominant virus found, followed by poliovirus 1, echovirus 6 and coxsackieviruses B2, B5, and B6. On several occasions, water that had been judged acceptable by current standards was found to contain viruses. Water samples with no detectable fecal or total coliform bacteria counts were shown to contain viruses. No statistical correlation could be detected between the occurrence of bacterial indicators and the presence of viruses in the water. Thus serious doubts were raised about the validity of the use of the indicator bacteria system to predict the virological quality of water. This is particularly true in countries with a high incidence of enteric viral disease. (Baker-FRC)
W81-02133

DEVELOPMENT OF THE FACTS PROCEDURE FOR COMBINED FORMS OF CHLORINE AND OZONE IN AQUEOUS SOLUTIONS,
American Univ., Washington, DC. Dept. of Chemistry.
J. Liebermann, Jr., N. M. Roscher, E. P. Meier, and W. J. Cooper.
Environmental Science and Technology, Vol 14, No 11, p 1395-1400, November, 1980. 5 Fig, 2 Tab, 16 Ref.

Descriptors: *Chlorine, *Ozone, *FACTS procedure, *Colorimetry, Water analysis, Analytical techniques, Pollutant identification.

The FACTS procedure (free available chlorine test with syringaldazine) was modified for determination of combined and total available chlorine and, with adaptation, for determination of ozone in aqueous solution. The color reaction obeyed Beer's Law over the range 0-10 mg per liter (as chlorine). The lower detection limit was 0.2 mg per liter. Color developed within 1 minute and for most samples was stable for 5 minutes. Comparison with the method for total available chlorine by amperometric titration gave a variance between the 2 sets of data of 0.643 mg per liter (as chlorine). The procedure for ozone obeyed Beer's Law from 0 to 4.5 mg per liter ozone and had a lower detection limit of 0.2 mg per liter. (Cassar-FRC)
W81-02142

SORPTION CAPACITIES OF GRAPHITIZED CARBON BLACK IN DETERMINATION OF CHLORINATE PESTICIDE TRACES IN WATER,
Rome Univ. (Italy). Ist. di Chimica Analitica
A. Bacaloni, G. Goretti, A. Lagana, B. M. Petronio, and M. Rotatori.
Analytical Chemistry, Vol 52, No 13, p 2033-2036, November, 1980. 3 Fig, 4 Tab, 17 Ref.

Descriptors: *Carbon, *Adsorption, *Pesticides, *Water analysis, Organic compounds, Tenax, Analytical techniques, *Pollutant identification, Solvents, Chlorinated hydrocarbon pesticides, Polychlorinated biphenyls.

Graphitized carbon black (surface area 100 sq meters per gram) was tested as an adsorbent for extracting trace organic pollutants from water using known concentrations of 51 organic compounds, includng organophosphorus and chlorinated pesticides, polychlorinated biphenyls (PCB), alcohols, polynuclear aromatic hydrocarbons, hydrocarbons, acids, phenols, ethers, aldehydes, ketones, and esters. Most compounds were 100% adsorbed. Exceptions were 1-hexanol, 1-heptanol, benzyl alcohol, penta- through octadecanes, acetophenone, benzaldehyde, and methyl esters of hexanoic through decanoic acids. Tests with alpha-benzene hexachloride using distilled water or drinking water, river water, and sea water showed differences in breakthrough curves depending on trace amounts of substances affecting solubility. Of 12 elution solvents, hexane-diethyl ether (1:1) proved best; the recovery was generally 100% with 50 ml eluant. PCB recovery with this solvent was 30-40%; therefore PCB interference in pesticide determinations was decreased. Comparisons with Tenax 80-100 mesh (2,6-diphenyl-p-phenylene oxide) showed that Tenax had lower retention times for several pesticides. (Cassar-FRC)
W81-02149

DETERMINATION OF ARENES, VINYL CHLORIDE, AND OTHER VOLATILE HALOORGANIC COMPOUNDS IN WATER AT MICROGRAM-PER-LITER LEVELS BY GAS CHROMATOGRAPHY,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
R. S. Narang, and B. Bush.
Analytical Chemistry, Vol 52, No 13, p 2076-2079, November, 1980. 5 Fig, 4 Tab, 7 Ref.

Descriptors: *Trihalomethanes, *Organic compounds, *Pollutant identification, Halogenated organic compounds, Water analysis, Vinyl chloride, Analytical techniques, *Gas chromatography.

Volatile halogenated organic compounds, such as chloroform, carbon tetrachloride, trihalomethanes, and di-, tri-, tetra- and hexa- halogenated ethylenes and ethanes, were stripped from water in a closed system, transferred to an adsorbent and eluted. This method, based on Grob's system, used Poropak N in place of charcoal as the adsorbent and methanol in place of carbon disulfide as the eluant. Eluted substances were separated by gas chromatography on a 3-meter Chromosorb 102 column (volatile haloorganics), SE-30 on Gas Chrom Q (arenes), and Poropak T (vinyl chloride). Photoionization detectors were used for arenes and vinyl chloride. This procedure, suitable for semiautomatic determinations, has detection limits of 1 microgram per liter for all compounds. (Cassar-FRC)
W81-02150

5B. Sources Of Pollution

A SIMPLIFIED STORMWATER QUANTITY AND QUALITY MODEL,
Akron Univ., OH. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E
W81-01924

CHARACTERIZATION, MAGNITUDE AND IMPACT OF URBAN RUNOFF IN THE GRAND RIVER BASIN,
Ontario Ministry of the Environment, Ottawa. Water Resources Branch.
S. N. Singer, and S. K. So.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173858, Price codes: A11 in paper copy, A01 in microfiche. In: Proceedings, Stormwater Management Model (SWMM) Users Group Meeting, 19-20 June, 1980, Toronto, Ontario, Environmental Protection Agency Report EPA 600/9-80-064, December, 1980, p 80-120. 17 Fig, 6 Tab, 10 Ref.

Descriptors: *Urban runoff, *Storm runoff, *Water pollution, Rivers, Canada, Storm water, Dissolved oxygen, Water quality, Nutrients, Phosphorus, Aquatic plants, Aquatic algae, *Grand River(Ontario).

Urban stormwater runoff has been recognized as a potential contributor of pollution to the Grand River in Ontario, Canada, and investigation of pollution from urban sources is an integral part of the basins water quality assessment program. The characteristics of urban runoff and the magnitude of the associated pollution loads from the cities of Brantford, Cambridge, Guelph, Kitchener and Waterloo are similar to those reported for other cities in Ontario. The impact of urban runoff from the five cities on the dissolved oxygen regime in the Grand River is minor. Parts of the Speed River below Guelph and certain reaches on the main Grand between Kitchener and Brantford suffer from profuse algae and plant growth during the summer and early fall period. This results in extremely low dissolved oxygen concentrations during the night due to the respiration process. High dissolved oxygen levels are observed during the day as a result of the photosynthesis process. Improvement of the dissolved oxygen regime would require the control of nutrient input, mainly phosphorus, from point and non-point sources. The nutrient input from urban runoff is small relative to agricultural diffuse sources and sewage treatment plants. Therefore priority for pollution control measures should be given to those two sources. (Moore-SRC)
W81-01926

A LONG-TERM DATA BASE FOR THE INVESTIGATION OF URBAN RUNOFF POLLUTION,
Technische Univ., Munich (Germany, F. R.).
W. F. Geiger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173858, Price codes: A11 in paper copy, A01 in microfiche. In: Proceedings, Stormwater Management Model (SWMM) Users Group Meeting, 19-20 June, 1980, Toronto, Ontario, Environmental Protection Agency Report EPA 600/9-80-064, December, 1980, p 212-233. 16 Fig, 9 Ref.

Descriptors: *Urban runoff, *Water pollution, *Data collections, *Monitoring, Storm runoff, Combined sewers, Storm sewers, Rainfall, Surface runoff, Water analysis, Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, Nutrients.

Realistic conclusions concerning receiving water pollution can not be derived from rainfall-runoff measurements or simulations of singular events. This is especially true of intermittent storm runoff and the resulting storm or combined sewer overflows. An instrumentation and monitoring program collecting rainfall, runoff, outfall and overflow data has been operated since 1976 in a sequence of closely spaced intervals in two test catchments: one a combined sewer system of 1340 acres, the other a small separate system of 57 acres. For water quality, total suspended solids, biochemical oxygen demand, chemical oxygen demand, Kjeldahl-nitrogen, total phosphorus and total organic carbon were analyzed. The amount of data collected per year is considerable. In 1977 and 1978 approximately one million pieces of data were collected, and therefore data storage and retrieval had to be completely computerized. The data acquired by a small computer at the monitoring station in the larger sewer system are punched on paper tape and then fed into a data bank. All laboratory data base has not been met. Data gaps of different lengths occurred due to mulfunctioning of individual recorders, the small processor at the monitoring station, or the sampler. The gaps in the runoff data may be filled with simulation results to provide a complete data base. (Moore-SRC)
W81-01932

ELEMENT FLOW IN AQUATIC SYSTEMS SURROUNDING COAL-FIRED PLANTS; WISCONSIN POWER PLANT IMPACT STUDY,
Wisconsin Univ.-Madison. Inst. for Environmental Studies.
A. Andren, M. Anderson, N. Loux, and R. Talbot.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-106833, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-076, July, 1980. 94 p, 28 Fig, 19 Tab, 85 Ref. R803971.

Descriptors: *Powerplants, *Fly ash, *Cooling water, *Water pollution sources, *Wisconsin, *Aquatic environment, Water quality, Coal-fired powerplants, Water chemistry, Nutrients, Hydrogen ion concentration, Waste water treatment, Chlorinated hydrocarbons, Trace elements, Copper, Dissolved oxygen.

Water quality parameters of a 192-ha cooling pond adjacent to the Columbia Generating Station, Portage, Wisconsin were investigated, including: major and minor elements, nutrients, pH, alkalinity, oxygen, chlororganics, phenols, and polyaromatic hydrocarbons. Similar parameters were also measured in the nearby fly ash discharge basin and its associated drainage stream. Except for copper concentrations, the overall water quality of the cooling basin is similar to that of many southern Wisconsin eutrophic lakes. Copper concentrations are generally below those levels thought to be toxic to aquatic life. Bottom waters may turn anoxic during late summer, causing nutrients from bottom sediments to be released to the overlying waters. Since nutrient release from bottom sediments to the water column may cause severe biological fouling problems, it is important to maintain oxygenated cooling pond waters at all times. Cooling pond water contained non-detectable levels of chlororganics and polyaromatic hydrocarbons, but bottom sediments contained measurable quantities of chlorinated phenols, phthalate esters, and polyaromatic hydrocarbons. Results from laboratory studies on dissolution and precipitation reactions of fly ash during equilibrium conditions can not be directly extrapolated to the ash basin at the Columbia Generating Station. Major element chemistry determines the reaction mechanism of fly ash dissolution by establishing solid-solution metastable equilibria. Elevated concentrations of aluminum, boron, cadmium, and copper are present in the fly ash basin at levels deemed toxic to aquatic life, and pH values are always in the range of 9 to 12. The elemental discharge from the ash basin has a negligible effect on the water quality of the Wisconsin River. (Moore-SRC)
W81-01934

ESTIMATION OF THE DOWNSTREAM RIVER WATER QUALITY WITH A POLLUTION LAND-USE DATA BANK,
Institut National de la Recherche Scientifique, Rimouski.
For primary bibliographic entry see Field 7B.
W81-01951

A COMPARISON OF NUTRIENT SOURCES AND BEHAVIOR IN TWO LOWLAND SUBCATCHMENTS OF THE RIVER WYE,
University of Wales Inst. of Science and Technology, Cardiff.
J. A. Houston, and M. P. Brooker.
Water Resources, Vol 15, No 1, p 49-57, January, 1981. 5 Fig, 5 Tab, 24 Ref.

Descriptors: *Nutrients, *Land use, *Livestock, *Watersheds, Drainage, Seasonal, Fluctuations, Water quality, Flow, Nitrate, Groundwater, Chemical analysis, River basins, Small watersheds, Path of pollutants, *Runoff, Dairy farms(Upland), Stock farms(Flood plains), *Wye River(UK), United Kingdom.

Seasonal fluctuations in nutrient flows were studied in two watersheds with different land uses. One site is in intensive floodplain stock farming and one is in upland dairy farming with a lower livestock density. Water samples were evaluated and river flows were measured at weekly intervals over a one year period. Additional data on sewage effluent contributions, groundwater quality and rainfall were collected. The study revealed good agreement between the two watersheds in the seasonal variations and magnitude of nutrient concentrations, including silicon and orthophosphate. Concentrations of nitrate nitrogen were higher in one of the watersheds. This result is attributed to greater contributions of sewage and to differences in the upland geology. It was found that overall, orthophosphate concentrations decreased and silicon and nitrate concentrations increased with increased flow caused by storm events. (Titus-FRC)
W81-01974

STUDY OF LITTORAL CURRENTS IN COSTA DEL SOL IN RELATION TO THE PLACEMENT OF SUBMARINE OUTFALLS ENVISIONED IN THE COMPREHENSIVE TREATMENT PLAN. (ESTUDIO DE CORRIENTES LITORALES EN LA COSTA DEL SOL, EN RELACION CON LOS EMPLAZAMIENTOS DE EMISARIOS SUBMARINOS PREVISTOS EN EL PROYECTO DE SANEAMIENTO INTEGRAL),
Ministerio de Obras Publicas, Madrid (Spain). Aplicaciones Nucleares.
For primary bibliographic entry see Field 6A.
W81-01975

GULF POLLUTION--UN'S OTHER WORRY,
R. Walgate.
Nature, Vol 287, No 5782, p 477, October, 1980.

Descriptors: *United Nations, *Oil pollution, *Kuwait, *Water pollution, Sewage, Water resources, Industrial wastes, Air pollution, Pollutants, Water quality, *Persian Gulf, Iraq, Iran.

The United Nations Environment Programme will assist countries in the Gulf of Kuwait area with planning and research into the sources and effects of pollutants in this fragile water supply. This body of water averages only 35 meters deep, and evaporates more water than it receives from river runoff. Little basic information exists on the Gulf's oceanography, ecology, and meteorology. Although these waters are needed for drinking, agriculture, and industry, they are exposed to many pollutants--heavy metals, noxious gases, oil, municipal sewage, and airborne dust. The institutions and equipment for pollution control have lagged behind the rapid population and industrial development. Hence, the need for research is great. (Cassar-FRC)
W81-01979

BEHAVIOUR OF NITRILOTRIACETIC ACID DURING GROUNDWATER RECHARGE,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands).
J. Hrubec, and W. van Delft.
Water Research, Vol 15, No 1, p 121-128, January, 1981. 7 Fig, 2 Tab, 18 Ref.

Descriptors: *Pilot plants, *Potable water, *Artificial recharge, *Water pollution control, Aquifers, *Detergents, Surface waters, Water quality, Public health, Groundwater recharge, Heavy metals, Path of pollutants, Water pollution sources, Percolation, Movement, Netherlands, Rhine River, *Nitrilotriacetic acid.

Research on trisodium nitrilotriacetate (NTA), a constituent of many detergents, has failed to provide sufficient information on the effects of this phosphate substitute in surface and groundwater sources for drinking water supplies. In the Netherlands, about 40% of the volume of surface water

used as potable water is infiltrated in the North Sea dune area as part of its treatment. Artificial recharge of Rhine River water has also been proposed in the Veluwe area. With these factors in mind, a pilot plant study was undertaken to examine the behavior of NTA during artificial groundwater recharge of Rhine River water. The Amsterdam Water Works pilot plant tests were also designed to obtain data on the possible mobilization of heavy metals from the soil of aquifers as a consequence of the formation of NTA-metal complexes. Experimental operations were based on fairly low recharge rates and aquifer groundwater environments that were mainly anaerobic. Results indicated that complete removal of NTA during percolation could be expected for NTA levels of up to 2 mg/l in surface water, even during events of low water temperatures. The mobilization of trace elements from the aquifer during the percolation of water containing low levels of NTA was not observed and was considered improbable. (Geiger-FRC)
W81-01981

PARTICULATE AND DISSOLVED TRACE METALS IN LAKE ONTARIO,
National Water Research Inst., Burlington (Ontario).
J. O. Nriagu, H. K. T. Wong, and R. D. Coker.
Water Research, Vol 15, No 1, p 91-96, January, 1981. 5 Tab, 32 Ref.

Descriptors: Heavy metals, *Trace elements, *Lake sediments, *Path of pollutants, Suspended solids, *Lake Ontario, Eutrophication, Sedimentation, Water pollution, Great Lakes, Movement, Nutrients, Fluctuations, Seasonal, Turnovers, Lakes.

Samples of Lake Ontario water and sediments were collected in the spring and summer of 1978 to determine the residence times of trace metals in the lake water column. Particulate metal levels in nanograms/liter for Cu, Cd, Ni, Zn, Mn and Fe were found to be 690, 40, 180, 1690, and 2100, respectively, in the nearshore waters of this Great Lake. These concentrations were considerably greater than the particulate metal levels in the offshore waters which were, in nanograms/liter, 130 for Cu, 8 for Cd, 34 for Ni, 230 for Zn, 110 for Pb, 260 for Mn, and 9000 for Fe. In general, the amount of trace metals bound to suspended solids in the lake water was calculated to be 50-80% for Cu, 10-40% for Ni, 20-60% for Cd, and greater than 60% for Pb. The average residence time of particulate metals in the water column of Lake Ontario was calculated to be 0.5 yr from data on the standing crop of the particulate metals and their estimated rates of deposition on the lake bottom. It was suggested that the particulate organic matter may play an important role in the transport of metals to Lake Ontario sediments. The effects of algal blooms on pollutant metal deposition into lake sediments are also mentioned. (Geiger-FRC)
W81-01983

MOUNT ST. HELENS ASH FALL IN THE BULL RUN WATERSHED, OREGON, MAY-JUNE 1980,
Geological Survey, Portland, OR. Water Resources Div.
M. V. Shulters, and D. G. Clifton.
Geological Survey Open-File Report 80-593, July, 1980. 11 p, 5 Fig, 3 Tab, 6 Ref.

Descriptors: *Volcanoes, *Environmental effects, *Water quality, *Large watersheds, *Oregon, Water supply, Fallout, Particle-size, Water pollution sources, Path of pollutants, Weather patterns, Water chemistry, *Mount St. Helens(WA), Bull Run watersheds(OR), *Volcanic ash, Acid rain.

On May 25-26, May 30-June 2, and June 12-13, 1980, strong, high-altitude winds from the north occurred during periods of volcanic-ash eruption at Mount St. Helens in southwestern Washington. As a result, ash fell in the Bull Run watershed, Oregon, some 50 miles to the south, the principal water-supply source for the Portland area. Samples from precipitation collectors and from stream sites in the Bull Run watershed were collected on several dates during May and June 1980. Analyses were made and are tabulated for pH, conductivity, acidity, sulfate, and nitrate plus nitrite. Field pH values of the precipitation ranged from 4.0 to 5.6 pH units and the stream samples from 6.7 to 7.5 units. Particle-size analyses for ash samples collected in the Bull Run watershed and Portland, Oregon, are also shown. Volcanic events, precipitation and high-altitude speeds for northerly winds are given for May 18-June 15, 1980. (USGS)
W81-02036

RESPONSE OF LEAD SOLUBILITY TO DISSOLVED CARBONATE IN DRINKING WATER,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
M. R. Schock.
Journal of the American Water Works Association, Vol 72, No 12, p 695-704, December, 1980. 16 Fig, 4 Tab, 44 Ref.

Descriptors: Corrosion, *Carbonates, *Pipes, *Lead, Solubility, Water pollution sources, *Potable water, Chemical properties, Pollutants, Metals, Heavy metals, Pipelines, Water distribution systems.

A model for relating the theoretical solubility curves for lead to changes in dissolved inorganic carbonate concentration and pH at 25C is presented. Calculated results agreed well with data obtained from pipe loop solubility experiments at inorganic carbonate concentration values of 25, 100, and 200 mg per liter as CaCO3. This model increases the predicted minimum molar solubility of lead by factors up to 10,000 over those suggested by 2 previous models which ignored lead carbonate complexes. A general reversal in trend occurs with increasing carbonate concentration, and curve shapes are changed compared with previous models. Results show that there is little advantage to increasing the carbonate level beyond 30-40 mg per liter as CaCO3 in the pH range of 8-9.5. A minimum concentration of carbonate overcomes the higher solubility of lead hydroxide, but an increase in carbonate promotes formation of more soluble lead carbonate complexes. None of the pipe loop tests reduced lead concentration to below the 0.05 mg per liter maximum contaminant level at carbonate concentrations of 0 to 7,950 mg per liter as CaCO3. (Cassar-FRC)
W81-02070

WATERBORNE DISEASE: OCCURRENCE IS ON THE UPSWING,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5C.
W81-02075

FEASIBILITY OF WATER QUALITY IMPROVEMENT IN THREE ILLINOIS RIVERS,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 5G.
W81-02083

VOLATILE HALOCARBON PRODUCTION FROM THE CHLORINATION OF MARINE ALGAL BYPRODUCTS INCLUDING D-MANNITOL,
Environmental Research Lab., Johns Island, SC. Bears Bluff Field Station.
A. M. Crane, P. Kovacic, and E. D. Kovacic.
Environmental Science and Technology, Vol 14, No 11, p 1371-1374, November, 1980. 3 Fig, 2 Tab, 30 Ref.

Descriptors: *Trihalomethanes, *Chlorination, *Marine algae, *Mannitol, Water quality, Chemical reactions, Chloroform, Organic compounds, Glycerol, Proline, Metabolism, Water pollution sources.

Three known byproducts of marine algae metabolism, D-mannitol, glycerol, and L-proline, were reacted with chlorine at molar concentrations of 0.003:0.009, 0.003:0.003, and 0.009:0.003 and pH 7 to 11.4 to investigate volatile halocarbon production. L-proline reduced Cl without concurrent production of halocarbons under all conditions. Glycerol and mannitol behaved similarly at pH 7 (4-10 micrograms per liter volatile halocarbons produced), but mannitol produced increased total volatile halocarbons (about 560 micrograms per liter) at the highest pH and highest mannitol concentration. Most of this was chloroform, with lesser amounts (16-61 micrograms per liter) of an unidentified product and traces of a third unidentified product. The mechanism of the D-mannitol reaction is believed to be ketolactone formation, followed by ring opening by chloride and the classical haloform process. (Cassar-FRC)
W81-02127

PREDICTION OF THE CONTAMINATION PRODUCED BY DISPERSION OF EFFLUENTS THROUGH OCEAN OUTFALLS. (PREDICCION DE LOS NIVELES DE CONTAMINACION PRODUCIDOS POR VERTIDOS REALIZADOS A TRAVES DE EMISARIOS SUBMARINOS.),
Ministerio de Obras Publicas, Madrid (Spain). Gabinete de Aplicaciones Nucleares.
A. Ruiz Mateo, and P. Sole Romeo.
Progress in Water Technology, Vol 12, No 1, p 301-320, 1980. 8 Fig, 18 Ref.

Descriptors: *Outfall sewers, *Waste dilution, *Diffusion, Mathematical models, Oceans, Flow, Regulation, Waste water treatment, *Spain, Dispersion.

Effluent dispersion after ocean outfall is examined. Spanish laws regulating such methods of treatment are discussed. Existing methods employed to calculate shoreline pollution resulting from outfall sewers and initial dilution of pollutants are discussed. A new mathematical model is presented which yields distribution curves for pollutants at various distances from the outfall. It is a two-dimensional relative diffusion model which divides the set of all possible flow structures into a useful finite number of subsets. (Small-FRC)
W81-02129

CONTRIBUTION OF MARINE ALGAE TO TRIHALOMETHANE PRODUCTION IN CHLORINATED ESTUARINE WATER,
Environmental Research Lab., Johns Island, SC. Bears Bluff Field Station.
A. M. Crane, S. J. Erickson, and C. E. Hawkins.
Estuarine and Coastal Marine Science, Vol 11, No 3, p 239-249, September, 1980. 6 Fig, 4 Tab, 22 Ref.

Descriptors: *Chlorophyll, *Marine algae, *Trihalomethanes, *Estuarine environment, *Chlorination, Algae, Halogenated compounds, North Edisto River, *South Carolina.

Algal metabolic byproducts other than chlorophyll were apparently responsible for trihalomethane formation upon chlorination of estuarine water from the North Edisto River, South Carolina, with sodium hypochlorite. Major trihalomethanes produced by chlorination of filtered estuarine water were bromoform ($CHBr_3$) and chlorodibromomethane ($CHBr_2Cl$). The trihalomethane production proceeded rapidly at first and, in the presence of sufficient chlorine, continued at a reduced rate. The presence of marine algae reduced or enhanced trihalomethane formation depending on species. No correlation was found between chlorophyll a concentration and halogen compound formation. However, water containing byproducts of algal metabolism, but no cells, behaved similarly to water containing cells upon chlorination. (Cassar-FRC)
W81-02131

GENERATION OF POLLUTING LOADS WITHIN RIVER BASINS,
National Inst. of Scientific Research, Quebec (Ontario).
D. Couillard, and D. A. Cluis.
Water Research, Vol 14, No 11, p 1621-1630, November, 1980. 3 Fig, 6 Tab, 21 Ref.

Descriptors: *Model studies, *Water pollution sources, *Land use, Water quality, Water quality control, *River basins, Path of pollutants, Water management, Urbanization, Nitrogen, Phosphorus, Nutrients, *Quebec, Hydrologic data, Networks, Saint-Francois River basin.

A water quality model was developed to estimate pollution loads along a hydrologic network based on inputs of various land uses along adjacent areas. Pollution load studies are incorporated to devise a simple production and transport scheme that may be used to estimate the quantity of pollution that may be found at any point along the hydrologic network on a daily, seasonal, or annual basis. The relative amounts of pollution produced by different contributing factors may be assessed, and the impact of various man-made changes such as urbanization, changes in livestock populations and deforestation on the origin of transported loads downstream from the affected zone may be evaluated. The model has been applied to calculate the maximum phosphorus and nitrogen concentrations along 17 simulation points within the hydrographic network of the Saint-Francois River Basin, Quebec. Results generated from the model may be useful to water resource managers in determining priority target sites for water quality improvement programs. (Geiger-FRC)
W81-02134

FIELD MEASUREMENT OF TRANSVERSE DIFFUSION IN UNDIRECTIONAL FLOW IN A WIDE, STRAIGHT CHANNEL,
Loughborough Univ. of Technology (England). Dept. of Civil Engineering.
A. P. Cotton, and J. R. West.
Water Research, Vol 14, No 11, p 1597-1604, November, 1980. 8 Fig, 2 Tab, 12 Ref.

Descriptors: *Model studies, *Mixing, *Dye dispersion, Channels, Mathematical models, River flow, Water quality, Estuaries, Rivers, Tracers, Diffusion, Rhodamine, Tracking techniques, Turbulence, Prototype tests, Path of pollutants.

Understanding factors which cause mixing in an open channel flow system is important to the study of pollution transport in rivers and saline intrusion in estuaries. Field studies were conducted to measure transverse diffusion coefficients in the River Rea, Birmingham, by use of a Rhodamine WT dye tracer technique. The present work done on this urban stream also focussed on determining the effect of the river flow and estimating the Lagrangian turbulence characteristics. Good dye recovery ratios and data reproducibility were obtained for a range of nearly steady discharge over straight stretches of the stream. The variation of the transverse diffusion coefficient and the dimensionless parameter (beta) with the river flow displayed a linear trend. The values of the dimensionless coefficient which were found were similar to those for other prototype investigations. (Geiger-FRC)
W81-02140

ELEMENTAL PARTITIONING IN AN ABOVEGROUND OIL SHALE RETORT PILOT PLANT,
Battelle Pacific Northwest Lab., Richland, WA. Physical Sciences Dept.
J. S. Fruchter, C. L. Wilkerson, J. C. Evans, and R. W. Sanders.
Environmental Science & Technology, Vol 14, No 11, p 1374-1381, November, 1980. 3 Fig, 6 Tab, 13 Ref.

Descriptors: *Pilot plants, *Trace elements, *Oil shales, *Effluents, Industrial wastes, Metals, Path of pollutants, Distillation, Fuels, Paraho, *Colorado, Elements(Chemical), Volatility, Inorganic compounds, Chemical wastes, Sulfur, Mercury.

Raw shale and effluent streams from the Paraho, Colorado, semiworks oil shale retort were analyzed for 47 elements using a variety of instrumental techniques to calculate mass balances for major and trace elements and to obtain information on their physical and chemical forms. The elements formed three groups, based on volatility. Category I includes the nonvolatiles, partitioned less than 0.01%, which may enter the entrained shale fines or exist as dissolved ionic species. Examples are Al, Ba, Ca, Cr, Mn, Na, Rb, Si, Cu, K, Mg, Mo, Pb, Sb, Sr, Th, Ti, U, V, and Zn. Category II elements, partitioned 0.01-5%, are primarily redistributed into the product shale oil and are associated with volatile metallic or organometallic compounds. This includes As, B, Co, Fe, Ni, and Se. Category III elements are partitioned more than 20%, are volatile, and include C, H, N, S, and Hg. These elements are found in the product oil and emitted gases. Sulfur is distributed as follows: retorted shale, 80.9%; product oil, 10.4%; product water, 2.5%; and gas, 12.7%. (Cassar-FRC)
W81-02141

FACTORS INFLUENCING THE FORMATION OF HALOFORMS IN THE CHLORINATION OF HUMIC MATERIALS,
Imperial College of Science and Technology, London (England).
C. J. Peters, R. J. Young, and R. Perry.
Environmental Science and Technology, Vol 14, No 11, p 1391-1395, November, 1980. 8 Fig, 2 Tab, 15 Ref.

Descriptors: *Trihalomethanes, *Chlorination, *Humic acids, *Fulvic acids, Chloroform, Water quality, Organic matter, Chemical reactions, Water treatment, Water pollution sources, Path of pollutants, *Thames River, England.

Humic acid and fulvic acid fractions isolated from the River Thames were chlorinated to examine haloform (as chloroform) production under conditions encountered in water treatment. Total chloroform was composed of 2 components--residual chloroform, produced from thermal decomposition of chlorinated intermediates, and dissolved chloroform. In both humic and fulvic fractions, dissolved chloroform production increased with both temperature and pH. Humic acid, which has a higher molecular weight and contains more active sites than fulvic acid, produced 1.64-1.68 times as much dissolved chloroform as did fulvic acid. Conversely, residual chloroform formation from both materials decreased with increases in pH from 7 to 9. Total chloroform formation reached a maximum between pH 7 and 8. A linear equation relates chloroform formation to chlorine consumption (all units mg per liter): Total chloroform concentration at time t = 0.022 (Initial chlorine concentration - Chlorine concentration at time T). Thus, the amount of trihalomethanes in drinking waters depends on the quality of the source water, process conditions during chlorination, pH, bromine versus chlorine balance, and storage conditions, which affect evaporative losses and decomposition of halogenated intermediates to form additional trihalomethanes. (Cassar-FRC)
W81-02143

ORGANIC COMPOUNDS IN AN INDUSTRIAL WASTE WATER. THEIR TRANSPORT INTO SEDIMENTS,
Midwest Research Inst., Kansas City, MO.
V. Lopez-Avila, and R. A. Hites.
Environmental Science and Technology, Vol 14, No 11, p 1382-1390, November, 1980. 7 Fig, 8 Tab, 16 Ref.

Descriptors: *Chemical wastes, *Industrial wastes, *Organic compounds, Path of pollutants, Water pollution, Pollutants, Analytical techniques, Chemical industry, Pollutant identification, Pawtuxet River, Narragansett Bay, Water analysis, Providence River, Waste water, *Sediments, *Rhode Island.

The environmental behavior of organic chemicals contaminating water and sediments of the Pawtuxet River and Cove, Providence River, and Narragansett Bay in Rhode Island was studied after prior investigations had identified over 120 different compounds in the waste water of a small chemical specialties manufacturer located upstream. Compounds identified included benzotriazole, chlorobenzotriazole, diphenyl ether, trichlorodiphenyl ether, dibenzoazepine, triazine, phenylbutazone, phenylnaphthylamine, stearyl alcohol and BHT ester. Water levels of the compounds followed the rules of simple dilution. Analysis of fine sediment cores produced good agreement with production histories of selected compounds. Some vertical mixing of sediment layers was seen. At the further stations contaminant concentrations decreased with both depth in sediment and distance from discharge. The most lipophilic compounds were the most highly associated with the particulate matter and were found at the greatest distance from the plant. An equation was developed to predict the sediment concentration: log (concentration in waste water/sediment concentration) = b1 + b2 (distance from plant/log P), where log P expresses the octanol/water partition coefficient. (Cassar-FRC)
W81-02144

HANDLING HAZARDOUS WASTE--AN UNSOLVED PROBLEM,
Environmental Defense Fund, Washington, DC.
D. J. Lennett.
Environment, Vol 22, No 8, p 6-15, October, 1980. 50 Ref.

Descriptors: *Waste disposal, *Water pollution, *Industrial wastes, *Hazardous materials, Hazards, Regulation, Legislation, Disposal, Landfills, Waste dumps, Legal aspects, Superfund bills, Resource Conservation and Recovery Act, Compensation, Penalties(Legal), Negligence, Public health, Water quality, Environmental Protection Agency.

This paper cites examples of groundwater contamination from improper disposal of hazardous wastes and discusses proposed and present legislation for hazardous waste handling and cleanup. Two Superfund bills are under serious consideration in Congress. H.R. 7020 creates a $1.2 billion fund for emergency response activity and remedial activity at top priority sites. No relief is provided for victims of releases from waste sites. The more comprehensive S.1480 proposes a $4.085 billion fund for cleaning up any hazardous substance release, compensates victims for damages, and provides for health studies and natural resource rehabilitation. Polluters are held strictly liable for cleanup and damages. Most chemical manufacturers oppose both bills, but a few favor H.R.7020. Environmentalists support S.1480. Although the Resource Conservation and Recovery Act (RCRA) became law in Oct. 1976, EPA has repeatedly failed to meet promulgation deadlines, leaving some measures still unfinalized 4 years after passage of the act. The author points out RCRA inadequacies, in addition to its incompleteness. Many toxic wastes are not yet identified as hazardous and escape regulation. The National Interim Primary Drinking Water Standards (NIPDWS) regulate only 14 substances (8 heavy metals and 6 organics). Sampling and extraction procedures for waste streams are very inadequate. Exemptions from regulations for small waste generators (less than 2,200 lbs per month), hazardous waste mixed with domestic sewage, and recycled and reused wastes ensure that much toxic material enters the environment. Interim state regulations are not uniform and fines are not punitive. Public opinion polls show that a large majority of Americans want stricter waste control even at the expense of higher cost for consumer products. (Cassar-FRC)
W81-02146

5C. Effects Of Pollution

X-RAY ANALYSIS OF SEDIMENT REGIONS AND TRANSPORT OF SEDIMENT PARTICULAR MATERIAL ON THE GILL OF THE FINGERNAIL CLAM, MUSCULIUM TRANSVERSUM,
Southern Illinois Univ. at Carbondale. Dept. of Zoology.
A. Paparo, J. A. Murphy, and R. Sparks.
In: 38th Annual Proceedings, Electron Microscopy Society of America, 1980, San Francisco, CA, p 562-563. 3 Fig. OWRT B-119-ILL(4).

Descriptors: *Sediments, Particle size, Sampling, Soil analysis, *X-Ray analysis, *Clams, *River beds, Aquatic life, Shellfish, Cores, Core logging,

Bottom sampling, Instrumentation, Laboratory tests, Soil investigations, Testing procedures, Variability, Soil chemistry, Inorganic compounds, Analytical techniques, Finite element analysis, Illinois, *Illinois River.

A sediment core of material was taken from the bed of a Mississippi River tributary, the Illinois River, divided into 4 samples (A-D, ranging from upper to lower region of the core), and particle matter from each sample was characterized by mean size (2.8-5.3 microns), mass (44.1-78.1 milligrams/liter), and concentration (2.8 million to 5.1 million particles/liter). Gill props were isolated, and subsequent measurement of the effects of temperature on sediment-transport rate (mm/second) for the 4 samples were determined from dorsal to ventral border of the gill. The two samples (A and B) from the upper core regions produced a significant cilio-inhibitory effect. Elemental analysis showed slightly higher calcium in samples A and B, with significantly greater amounts of manganese and phosphorus in B. These results support the findings that the greatest chilio-inhibition occurred in region B. The sediments studied were deposited approximately in the mid-1950's, when fingernail clams disappeared from a 100-mile section of the Illinois River. Restoration of clam populations would dramatically increase fish production and diving duck activities, illustrating the importance of assessing sediment quality effects on lower organisms. (Zielinski-IPA)
W81-01903

SILICON SUBSTITUTION FOR CALCIUM IN THE SHELL OF THE FINGERNAIL CLAM, MUSCULIUM TRANSVERSUM STUDIED BY X-RAY ANALYSIS,
Southern Illinois Univ. at Carbondale. Center for Electron Microscopy.
J. A. Murphy, A. Paparo, and R. Sparks.
In: 38th Annual Proceedings, Electron Microscopy Society of America, 1980, San Francisco, CA, p 560-561. 4 Fig. OWRT B-119-ILL(3).

Descriptors: *Water pollution effects, *Clams, *Calcium, *Silicates, *X-ray analysis, River beds, Sediments, Nutrients, Instrumentation, Mortality, Water quality, Research and development, Aquatic life, Shellfish, Aquatic animals, Illinois, Testing procedures, Sampling, Finite element analysis, Analytical techniques, Calcium compounds, *Illinois River.

In the mid-1950's, fingernail clams disappeared from a 100-mile section of the Illinois River, a Mississippi River tributary. Factors in the river and/or sediment prevent clams from recolonizing areas where they were formally abundant. Experiments showed greatest clam mortality and highest incidence of shell deformations occurred in test chambers containing the highest proportion of river water to well water. The molluscan shell consists of calcium carbonate, probably derived from metabolic carbon dioxide. This study examined the role of raw river water and well water on shell formation in the fingernail clam. Normal fingernail clams from the Keokuk Pool of the Mississippi developed bizarre shell deformation and died without reproducing after 4 weeks in well water containing a known composition of trace metals. X-ray analysis showed the principal component of the shells was calcium, in shell layers that were laid down when clams were still in the Mississippi. When clams were introduced to well water, shell calcium dropped and silicon became the predominant element, particularly in the shell deformity area. It was concluded that the Ca/Si ratio in normal portions of clam shells is almost the reverse of that in deformed shell parts. (Zielinski-IPA)
W81-01904

A RESEARCH STRATEGY FOR ANTICIPATING CONTAMINANT THREATS TO AQUATIC RESOURCES,
Columbia National Fisheries Research Lab., MO.
R. A. Schoettger, and J. L. Ludke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657, Price codes: A12 in paper copy, A01 in microfiche.
In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR, Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 1-17. 8 Fig.

Descriptors: *Aquatic environment, Water pollution, *Wildlife, *Research priorities, Planning, Management, Project planning, Water pollution control, Pollution abatement, Aquatic life, Forecasting, Forecasting, *Water pollution effects, *Ecosystems.

The Environmental Contaminant Evaluation Program of the Fish and Wildlife Service is emphasizing a predictive approach to identify potential contaminant problems and preventing or ameliorating adverse effects of contaminants on ecological systems. Because manpower and scientific resources are limited, the environmental research community must emphasize the necessity of placing priorities on fishery and wildlife resources. A strategy was developed that accentuates the anticipation of new or previously unrecognized pollution problems, while continuing to address old problems that remain a concern. The approach draws upon a number of different sources to assist in the identification of present and potential contaminant effects. Information and data that relate to topics of concern are reviewed by scientists and resource managers to develop an overview of a problem and to determine data needs. A research design is then formulated to provide information on the real or potential effects a contaminant may have on aquatic organisms or ecosystems. Corrective or preventive alternatives that include one or more of the following may then be recommended: legislative action to regulate or prohibit the chemical; modification of management techniques; changes in the use of certain chemicals; substitute less harmful chemicals, selection of a less harmful activity or process. The stategy insures that resource managers are involved in the process of problem identification and formulation of research design, so that the objectives and results are applicable to the actual environmental problems that confront the aquatic resources. (Moore-SRC)
W81-01906

PRINCIPLES OF ESTIMATION OF NORMAL AND PATHOLOGIC STATES OF RESERVOIRS WITH CHEMICAL POLLUTION,
Moscow State Univ. (USSR). Faculty of Biology and Soil Science.
N. S. Stroganov.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657, Price codes: A12 in paper copy, A01 in microfiche.
In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR, Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 18-33. 4 Fig, 8 Ref.

Descriptors: *Water pollution, Potable water, *Aquatic life, *Limnology, *Reservoirs, *Water pollution effects, Water quality, Commercial fish, Commercial shellfish, Water utilization, Aquatic environment.

A need has been demonstrated for giving hydrobioloical principles priority over other principles in the evaluation of the status of a reservoir. Based on the requirements of a reservoir in terms of preservation of hydrobiological processes assuring pure water of good quality and productivity of valuable commercial species, the following four principles should be used as a basis for standardization of water quality in fresh surface bodies of water: priority in the use of reservoirs; sufficient self-purification; assurance of life for commercial species; suitability of water for drinking. Under all conditions, man is the main standard for evaluation of normality or abnormality of a body of water. It is not simply the number and variety of species which are important, but rather useful species and their populations and productivity; not simply the stability of the system, but rather the stability of the required quality of the system. An aquatic ecosystem may be stable both with polysaprobic pollution and with oligosaprobic pollution, but preference is given to the oligosaprobic state of a reservoir over the polysaprobic state. For aquatic organisms, a normal body of water is that which best corresponds to their physiologic and biologic peculiarities. (Moore-SRC)
W81-01907

THEORETICAL ASPECTS OF THE 'NORMALCY AND PATHOLOGY' PROBLEM IN AQUATIC ECOTOXICOLOGY,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
L. P. Braginsky.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657, Price codes: A12 in paper copy, A01 in microfiche.
In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borak, Jaroslavl Oblast, USSR, Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 34-43. 9 Ref.

Descriptors: *Aquatic environment, *Toxicity, *Water pollution, *Aquatic life, Ecosystems, Entropy, Biological communities, Dominant organisms, Pathology, Water properties.

Ecotoxicology, a new trend in ecology, deals not with the individual organism response to toxic effects but with the response of the community and ecosystem, as well as the transformation of toxicants in natural ecosystems. The notions of normal and pathological states of aquatic ecosystems are closely associated with the whole complex of other ecological concepts such as preservation of homeostasis, transformation of community structure, a shift of dominant forms, disturbances of bio-geochemical cycles, system buffering, detoxification potential and, with the concept of entropy and negative entropy system. From this point of view, the study of the general problems of pathology of aquatic ecosystems is considered in the light of the second principle of thermodynamics. The consideration of the problem of detoxification of waters should then be from the view of life as a negatively entropic process, evoked by our planet to retain energy, and to prevent its dispersion into space. The analysis of aquatic ecosystem responses to toxicant effects in the light of the second principle of thermodynamics may significantly stimulate our understanding of the destructive and reduction processes and factors, determining the stability and degradation of aquatic ecosystems, and the hydrobiosphere as a whole. (Moore-SRC)
W81-01908

TRENDS IN AQUATIC TOXICOLOGY IN THE UNITED STATES: A PERSPECTIVE,
Columbia National Fisheries Research Lab., MO.
F. L. Mayer, Jr., P. M. Mehrle, Jr., and R. A. Schoettger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657, Price codes: A12 in paper copy, A01 in microfiche.
In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR, Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 44-59. 2 Fig, 1 Tab, 49 Ref.

Descriptors: *Toxicity, *Aquatic environment, *Water pollution, *Ecosystems, Pesticide residues, Pesticides research priorities, Mining, Agriculture, Forestry, Sewage disposal, Invertebrates, Aquatic plants, Fish, Pesticide toxicity.

Research approaches are changing from acute toxicity testing and residue analysis to more complex and integrated research involving chronic toxicity, clinical chemistry, and ecosystem concepts. These approaches are resulting in assessments of the environmental hazard of contaminants, sometimes even before they enter the environment, rather than in the production of acute toxicity and residue data of only limited value. Developmental research is providing better interpretation and shortcuts in toxicology. In ecosystem studies, scientists are determining what really must be measured to assess the

ype and degree of pollution; biochemical techiques are decreasing the time required for chronic oxicity studies; and plants and invertebrates are eing recognized for their importance to fish and quatic ecosystems and are being tested according-y. Recognition of the complexity of aquatic conaminant residues has led to increased emphasis on he development of integrated strategies for their etection and analysis. Research emphasis has hifted to the prediction of problems that may arise s mining, smelting and coal conversion are inreased, new methods of sewage disposal, petroeum and detergent use expands, and pesticides use hanges inforest, range, and agricultural practices. (Moore-SRC)
W81-01909

COMPARISON OF PRINCIPLES OF DEVELOPMENT AND USE OF WATER QUALITY STANDARDS IN THE USSR AND USA,
Leningrad Research Inst. of Lake River and Fishng Management (USSR).
L. A. Lesnikov.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657, Price codes: A12 in paper copy, A01 in microfiche. In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR, Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 60-74. 2 Tab, 59 Ref.

Descriptors: *Water quality standards, *Toxicity, *Aquatic life, *Water pollution, *Ecosystems, Aquatic animals, Fish, Algae, Plankton, Microorganisms, Invertebrates, Water chemistry, Aquatic environment, United States, Russia.

In the USSR, about 600 sanitary-hygienic maximum permissible concentrations (MPC) have been developed for harmful substances, as well as 210 fishing industry MPC's. In the USA, reports have been published on the degree of harm of a similar number of substances, primarily from short-term experiments. In order for one nation to use data obtained by another nation it is necessary to gain some idea concerning the relative toxicity resistance of test organisms. Representatives of local aquatic fauna are used both in the USSR and in the USA. Comparison of tests on fish, algae, zooplankton, benthic invertebrates, microorganisms, and hydrochemistry indicates that, with the exception of a small number of tests, the studies in the two countries generally have the same goals, and are performed according to basically similar methods. The MPC system used in the USSR is equivalent in the nature of its scientific foundation to the concept of the water quality criterion used in the USA, while the water quality standards used in the USA are more or less equivalent to the discharge norms or maximum permissible discharges used in the USSR. A classification of the relative toxicoresistance of test organisms used in the USSR and USA can be used to compare studies on the toxicity of water pollutants. (Moore-SRC)
W81-01910

CHLORINATED HYDROCARBONS AS A LIMITING FACTOR IN THE REPRODUCTION OF LAKE TROUT IN LAKE MICHIGAN,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
W. A. Willford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657, Price codes: A12 in paper copy, A01 in microfiche. In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR, Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 75-83. 2 Fig, 15 Ref.

Descriptors: *Lake trout, *Lake Michigan, *Fish reproduction, *DDE, *Polychlorinated biphenyls, *Toxicity, Chlorinated hydrocarbons, Pesticides, Fry, DDT, Fish stocking, Water pollution, Mortality, Pesticide residues, Fish physiology.

Due to an ongoing lake trout restocking program which began in 1965 in Lake Michigan, by the early 1970's, the lake trout were once again considered abundant in Lake Michigan and spawning activity was widespread. Nevertheless, no naturally produced fingerlings or older lake trout have been found in the lake during sampling. The lake trout were known to contain substantial residues of DDT and its metabolites and of polychlorinated biphenyls, but the existing levels in eggs did not significantly affect survival in eggs or of early stages of the fry. Lake Michigan lake trout fry were exposed for 6 months to DDE and polychlorinated biphenyls at levels approximating exposure received by fish, and at concentrations 5 and 25 times these values, in water and food. The final cumulative mortality of fry in the simulated Lake Michigan exposure was 40.7%, or nearly double the final cumulative mortality of the controls. At the highest combined level of polychlorinated biphenyls and DDE tested, 46.5% of the fry died. During the chronic exposure, observations were made periodically on the growth, swimming performance, predator avoidance, temperature preference, and metabolism of the fry. In general, the exposed fry showed no significant physiological effects attributable to the exposure. The current levels of polychlorinated biphenyls and DDE in the lake appear sufficient to impede the restoration of self-sustaining populations of lake trout in Lake Michigan. (Moore-SRC)
W81-01911

ORGANOPHOSPHORUS PESTICIDES AND THEIR HAZARDS TO AQUATIC ANIMALS,
Akademiya Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod.
V. I. Kozlovskaya, and B. A. Flerov.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657, Price codes: A12 in paper copy, A01 in microfiche. In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR, Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 84-96. 4 Fig, 7 Tab, 25 Ref.

Descriptors: *Organophosphorus pesticides, *Toxicity, *Invertebrates, *Water pollution effects, Aquatic animals, Pesticides, Agricultural runoff, Enzymes, Animal physiology, Animal behavior, Aquatic environment.

Organochlorine pesticides have been replaced with organophosphorus pesticides on the assumption that as a result of lower persistence in the aquatic environment, organophosphorus pesticides will be of little danger to aquatic organisms. However, organophosphorus pesticides have proven to be highly toxic to the majority of species of aquatic invertebrates. The concentrations found in some bodies of water greatly exceed lethal levels for sensitive species. The intensive application of organophosphorus pesticides as a part of agricultural practices results in a periodic influx of these pesticides into bodies of water. In natural waters, pollution levels are produced which cause chronic effects on aquatic animals. This is especially dangerous because organophosphorus compounds possess an additive effect; and are poorly avoided by aquatic animals. An indicator of the effects of organophosphorus pesticides is an inhibition of cholinesterase in both acute and chronic intoxication. In pathological processes, the inhibition of cholinesterase as a target enzyme undoubtedly plays a leading role, although death occurs when the inhibition of enzymes is still incomplete. (Moore-SRC)
W81-01912

MONITORING CONTAMINANT RESIDUES IN FRESHWATER FISHES IN THE UNITED STATES: THE NATIONAL PESTICIDE MONITORING PROGRAM,
Columbia National Fisheries Research Lab., MO.
J. L. Ludke, and C. J. Schmitt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657, Price codes: A12 in paper copy, A01 in microfiche. In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR, Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 97-110. 4 Fig, 5 Tab.

Descriptors: *Pesticides, *Water pollution, *Fish, *Monitoring, Aquatic environment, DDT, Pesticide residues, Chlorinated hydrocarbon pesticides, Distribution, Polychlorinated biphenyls, Toxaphene, Endrin, Dieldrin, Cadmium, Lead, Mercury, Arsenic, Selenium, Freshwater fish.

Monitoring contaminants in freshwater fish has undergone a series of changes since collections began in 1967. At first, fish were collected from 50 sampling stations in the Great Lakes and major rivers throughout the United States, in the spring and again in the fall. There are now 117 stations where fish are collected for analysis of contaminant residues. About half of the stations are sampled in the fall of even-numbered years and the other half during odd-numbered years. At each trend monitoring station, three samples of five fish each are taken: two samples of a bottom-dwelling species and one of a predator species. The number of contaminants studied has increased from 8 in 1967 to more than 20 today. Residues of DDT and its metabolites in fish from the major rivers and lakes have shown a continuing downward trend. The number of sites where DDT has been observed in at least one sample has also decreased somewhat since 1970. Polychlorinated biphenyls have become virtually ubiquitous, reflecting the former widespread use of these persistent industrial compounds. Polychlorinated biphenyls occur in fish tissues most frequently and at the highest concentration in the industrial northeastern and midwestern sections of the United States. Mean toxaphene residues are increasing in freshwater fishes, and toxaphene occurs much more widely now than in past years. Nationally, average residues of dieldrin and endrin in fish tissues have remained essentially unchanged from 1970 through 1977. The fish samples collected in 1977 were analyzed for cadmium, lead, mercury, arsenic and selenium. Background levels for the metals were determined, as well as geographic areas where these levels are exceeded. (Moore-SRC)
W81-01913

ACCUMULATION AND METABOLISM OF PERSISTENT PESTICIDES IN FRESHWATER FISH,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
F. Y. Komarovskiy, and A. Y. Malyarevskaya.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657, Price codes: A12 in paper copy, A01 in microfiche. In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR, Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 111-117. 10 Ref.

Descriptors: *DDT, *Freshwater fish, *Pesticide residues, *Water pollution effects, DDE, DDD, Chlorinated organic pesticides, Metabolism, Daphnia, Food chains, Carp, Perches, Bream, Tubificids, Aquatic animals.

The accumulation and transformation of organochlorine pesticides, especially DDT has been well demonstrated in terrestrial and marine ecosystems, but has received little attention in freshwater ecosystems. Experimental efforts have been directed toward three major areas: a demonstration of the level of persistent pesticides in aquatic ecosystems and the organisms under examination; experiments in vitro to demonstrate the accumulation of residues of DDT and its metabolites in selected organs and tissues of fish, and to describe the development of intoxication in time; studies in experimental basins to establish accumulation and transformation of persistent pesticides at different topic levels. The following fish species were used; bream, pike perch, pike, perch, carp, crucian carp, and silver carp. The food organisms tested include tubificids and daphnia. The concentrations of DDT, DDE and DDD in water were found to be in the parts per trillion and parts per billion range. Sediment

values were in the range of parts per billion and parts per million. In freshwater fish, residual quantities of DDT and its metabolites are mainly accumulated in fatty and brain tissues. The predominance of DDE and DDD in storage indicates that DDT undergoes substantial changes. Toxicological symptoms appear in parallel with increasing levels of DDT in target organs, especially in the brain, when DDT and its metabolites accumulate up to 3 ppm in the brain tissue of fish, the fish die with obvious symptoms of cumulative toxicosis. In a food chain study it was found that tubificids metabolize DDT only to DDD; daphnia to DDD and DDE, carp to DDD and DDE, and perch and pike to DDD and DDE, but at a different ratio. (Moore-SRC)
W81-01914

SOME FACTORS AFFECTING THE TOXICITY OF AMMONIA TO FISHES,
Montana State Univ., Bozeman. Fisheries Bioassay Lab.
R. V. Thurston.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657. Price codes: A12 in paper copy, A01 in microfiche. In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR. Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 118-137. 7 Fig, 38 Ref.

Descriptors: *Toxicity, *Ammonia, *Fish, Temperature, Dissolved oxygen, Hydrogen ion concentration, Environmental effects, Aquatic environment, Water pollution, Rainbow trout, Water quality standards, Acclimation.

Reported acute toxicity ammonia values for a variety of species of fishes range between 0.25 and 4 mg/liter un-ionized ammonia, and other manifestations have been reported at concentrations as low as 0.01 mg/liter. Some of the factors that increase or decrease the toxicity of ammonia are considered in relation to the water quality standard for ammonia. There is evidence that fish with a history of prior acclimation to some sublethal concentration of ammonia are better able to withstand an acutely lethal concentration, at least for some period of hours and possibly days. A drop in temperature below some optimum range for a given species of fish may increase its susceptibility to ammonia toxicity. The available evidence that temperature, independent of its role in the aqueous ammonia equilibrium affects the toxicity of ammonia to fishes argues for further consideration of the relationship. For rainbow trout under bioassay conditions, there was a 30% decrease in the median lethal concentration of ammonia when the dissolved oxygen concentration dropped from 8 to 5 mg/liter. Results of tests in fish indicate that ionized ammonia may exert a heretofore unrecognized toxic effect on fish, or that the toxicity of unionized ammonia increases as the hydrogen ion concentration increases. These examples of how the many chemical and physical parameters involved in aqueous systems are interrelated in affecting the toxicity of a pollutant illustrate the complexities in establishing water quality criteria and setting standards. (Moore-SRC)
W81-01915

THE PREDICTION OF THE EFFECTS OF POLLUTANTS ON AQUATIC ORGANISMS BASED ON THE DATA OF ACUTE TOXICITY EXPERIMENTS,
Moscow State Univ. (USSR). Faculty of Biology and Soil Science.
O. F. Filenko, and E. F. Isakova.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657. Price codes: A12 in paper copy, A01 in microfiche. In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR. Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 138-155. 5 Fig, 5 Tab, 8 Ref.

Descriptors: *Toxicity, *Water pollution, *Daphnia, Aquatic animals, Invertebrates, Mortality, Aquatic environment, Time, Water quality standards, Forecasting.

The increasing number of pollutants requires acceleration of the ability to assess their toxicity, and to determine acceptable levels in the environment. This requires a reduction in the length of experimental effort, and an increase in the reliability of the response. To test the reliability of acute toxicity tests for predicting the effects of pollutants, the toxic effect of some potential water pollutants was assessed by organism survival in Daphnia. Analysis of the data from this experiment indicates that the dynamics of the results of toxic influence for aquatic organisms can be shown as a combination of simpler processes. The connection of mortality with time, and the onset of given effects with concentration can best be described by power function equations. For evaluation of regression equations describing these statistically reliable relationships, 3 to 4 experimental points are necessary. These equations can be used for determination of the effects of the pollutant on the organisms for a period that exceeds the duration of observation, and for concentrations that have not been experimentally investigated, including an approximation of acceptable concentrations of the pollutant in the aquatic environment (Moore-SRC)
W81-01916

AGE SPECIFICS OF SENSITIVITY AND RESISTANCE OF FISH TO ORGANIC AND INORGANIC POISONS,
Akademiya Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod
V. I. Lukyanenko.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657. Price codes: A12 in paper copy, A01 in microfiche. In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR. Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 156-170. 12 Ref

Descriptors: *Toxicity, *Fish, *Growth stages, *Pesticides, Fish eggs, Fry, Larvae, Water pollution, Age, Heavy metals, Phenols, Metaphos, Yalan, Propanid, Cadmium, Cobalt

Conflicting results have previously been obtained concerning the level of toxicoresistance of various stages of ontogenesis of fish, resulting from the different natures of the toxic substances studied, and the differences in mechanism of action of the organic and inorganic poisons. The dynamics of toxicoresistance was studied in embryos, larvae, and fry of rainbow trout, bream, zope, carp, Russian sturgeon, Caspian sturgeon, sterlet and giant sturgeon. The toxic substances used represented a broad range of concentrations of phenol, metaphos, yalan and propanid as well as chlorides of cadmium and cobalt. The level of toxicoresistance is found to be determined not only by the direction and intensity of metabolic processes in fish in various stages of ontogenesis, but also by the nature of the toxic agent used. The resistance of many species of fish to many organic poisons decreases with ontogenetic development and reaches a minimum in sexually mature fish. The process is not uniform, and periods of high resistance alternate with periods of low resistance. The resistance of fish to inorganic poisons, and particularly heavy metal salts, is minimal in the larval and fry periods. The increased toxicoresistance of eggs make the use of eggs as test objects undesireable in studies of the toxicity of various substances and in biological testing of natural and waste waters; larvae and fry are preferable. (Moore-SRC)
W81-01917

SYNERGISTIC EFFECTS OF PHOSPHORUS AND HEAVY METAL LOADINGS ON GREAT LAKES PHYTOPLANKTON,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
E. F. Stoermer, L. Sicko-Goad, and D. Lazinsky
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657. Price codes: A12 in paper copy, A01 in microfiche. In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR. Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 171-186. 11 Fig, 1 Tab, 17 Ref

Descriptors: *Great Lakes, Phosphorus, *Heavy metals, *Eutrophication, *Phytoplankton, Algae, Limnology, Water pollution, Lead, Lake Huron, Nutrients, Phosphates, Chlorophyta, Cyanophyta, Diatoms, Chrysophyta, Polyphosphate bodies, *Synergistic effects.

During an investigation of Saginaw Bay, it became apparent that certain species of phytoplankton were surviving transport out of the bay into Lake Huron, which was unexpected because the species have high nutrient requirements which cannot be satisfied in Lake Huron. Internal stores of phosphorus in the form of polyphosphate bodies were found in these populations. X-ray analysis further showed that the polyphosphate bodies also contained appreciable quantities of lead. Observations were made on natural phytoplankton assemblages collected and fixed under field conditions, natural assemblages subjected to experimental nutrient and heavy metal additions in the laboratory; and populations isolated from the lakes and maintained in the laboratory. The occurrence of polyphosphate bodies in eutrophication tolerant phytoplankton species was found to be widespread in Saginaw Bay, even in areas where the water showed low levels of dissolved phosphorus. Polyphosphate bodies were particularly apparent in cells of some of the potentially nuisance producing blue-green algae. Polyphosphate bodies were also found in green algae, diatoms, Chrysophyceae and Prymnesiophyceae. They were not found in Cryptophyceae and euglenoids. Polyphosphate accumulation may be triggered by deficiency in some critical nutrient in the presence of excess exogenous phosphorus, stress invoked by excess levels of micronutrients, or simply by the restoration of excess exogenous phosphorus to cells previously stressed by deficiency of phosphorus. Any or all of these conditions are apt to be present in mixing zones where contaminated stream flows enter the Laurentian Great Lakes. Phosphorus bound in polyphosphate bodies may be transported out into the open waters of the lakes, as may be lead. This may be an important mechanism of pollutant dispersal in the Laurentian Great Lakes. (Moore-SRC)
W81-01918

REVERSIBILITY OF INTOXICATION AND FACTORS GOVERNING IT,
Akademiya Nauk SSSR, Petrozavodsk. Dept. of Water Problems
I. V. Pomozovskaya
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657. Price codes: A12 in paper copy, A01 in microfiche. In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR. Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 187-200. 2 Fig, 8 Tab, 9 Ref.

Descriptors: *Toxicity, *Fish, *Waste water(Pollution), Water pollution effects, Pulp wastes, Sewage effluents, Temperature, Time, Fish physiology, Aquatic environment, Growth stages, *Fish management

The possibility of reversibility of intoxication is important in predicting results for organisms that undergo short duration exposure in the polluted zone during crises, and in the case of salvo discharges. Atlantic salmon, cisco, roach, perch, and pike were exposed to both concentrated and dilute waste waters and then transfered to pure lake water after signs of intoxication appeared, in order to determine the degree of reversibility of intoxication. The study employed unpurified multi-component wastes from sulfate pulp production, sewage from sulfate pulp production, sewage from sewage treatment plants, and wastes from heat and power stations. Fish of the first year of life were used. The main sign of intoxication, which served as a

signal for transferring fish to pure water, was most often the loss of the equilibrium relfex, and a transition to the inverted state. In some cases, the fish were subjected to a sequence of two to four exposures in the waste waters. The degree and dynamics of intoxication reversibility depended upon the temperature, the concentration of toxicants, the duration of exposure, the test species, and the age of the fish. Even brief exposure to sulfate-cellulose discharges, with subsequent migration to pure water, does not guarantee fish safety, and can be especially dangerous when combined with high temperature regimes. (Moore-SRC)
W81-01919

ASPECTS OF THE INTERACTION BETWEEN BENTHOS AND SEDIMENTS IN THE NORTH AMERICAN GREAT LAKES AND EFFECTS OF TOXICANT EXPOSURES,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
J. A. Robbins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657, Price codes: A12 in paper copy, A01 in microfiche. In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR, Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 201-225. 13 Fig, 3 Tab, 19 Ref.

Descriptors: *Great Lakes, *Benthos, *Sediments, *Water pollution effects, Nutrient cycling, Sediment transport, Oligochaetes, Amphipods, Lake Huron, Diptera, Larvae, Silicon.

Fine-grained sediments are both the ultimate sink and partial source of nutrients in the Great Lakes, and the life activities of the benthos are likely to be an important factor in the nutrient cycle. If the behavior, physiology, or mortality of benthos are affected by aquatic pollutants, there can be potentially novel and important effects on major nutrient cycles. To investigate the role of benthos in the transport of sediment particles, illite clay particles with adsorbed cesium-137 were added as a submillimeter layer to the surface of fine-grained sediments contained in plastic cells in a temperature regulated aquarium. A gamma detector scanned the cells at daily or weekly intervals over a period of several months to determine how oligochaete worms or amphipods transported labeled particles away from the sediment surface. The oligochaetes rework the sediments by burial, while the amphipods burrow randomly from the surface, and move the particles in a manner akin to eddy diffusion. By using both cesium-137, and the relatively conservation gamma emitting isotope sodium-22, reworking rates and molecular diffusion rates were determined simultaneously for cells with and without oligochaetes, it was found that the presence of tubificid worms at a density of about 70,000 per square meter enhances the diffusion coefficient by a factor of over three. Based on studies of benthos density and silicon flux in Lake Huron, chironomid larvae may play a major role in the regeneration of silicon from sediments, at least in shallow waters where fine-grained sediments can be found. (Moore-SRC)
W81-01920

RECENT ADVANCES IN THE STUDY OF NITRITE TOXICITY TO FISHES,
Montana State Univ. Bozeman. Fisheries Bioassay Lab.
R. C. Russo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226657, Price codes: A12 in paper copy, A01 in microfiche. In: Proceedings of the Third USA-USSR Symposium on the Effects of Pollutants upon Aquatic Ecosystems, July 2-6, 1979, Borok, Jaroslavl Oblast, USSR, Environmental Protection Agency Report EPA-600/9-80-034, July, 1980, p 226-240. 6 Fig, 2 Tab, 25 Ref.

Descriptors: *Toxicity, *Fish, *Nitrites, Water pollution effects, Water chemistry, Hydrogen ion concentration, Nitrous acid, Rainbow trout, Growth stages, Chlorides, Calcium, Sea water, Methemoglobinemia.

Nitrite is produced as an intermediate product in the nitrification process and under some circumstances may be present in natural waters at levels high enough to be deleterious to freshwater life. Concentrations as low as 0.2 mg/l nitrite-nitrogen are acutely lethal to several species of fish, while some species can tolerate short-term exposures to concentrations of 67 to 100 mg/l. In 20 96-hour nitrite bioassays on rainbow trout over the size range 2 to 387 g, no relationship between fish size and susceptibility to nitrite was found. A significant reduction in nitrite toxicity results from increased levels of chloride ion, and other anions also exhibit, in different degrees, an inhibitory effect on nitrite toxicity. Calcium and seawater also decrease the toxicity of nitrite. An additional factor that should be considered is the pH of the solution. The toxicity of nitrite to rainbow trout was studied over the pH range 6.4 to 9.0 to examine the effect of pH, and to determine whether toxicity could be attributed to the nitrous acid concentration. Results suggest that neither chemical species alone is responsible for the entire toxicity. The toxicity of nitrite decreases with increasing pH. Methemoglobinemia is considered to be one mechanism by which nitrite is toxic to fishes, but it is probably not the only mode of toxic action. (Moore-SRC)
W81-01921

IONOPHORE-MEDIATED CALCIUM CONTROL OF CILIARY ARREST IN THE FINGERNAIL CLAM, MUSCULIUM TRANSVERSUM,
Southern Illinois Univ. at Carbondale.
A. A. Paparo, K. Cunningharn-Paparo, and R. Sparks.
Comparative Biochemistry and Physiology, Vol 66A, p 355-357, 1980. 4 Fig, 11 Ref. OWRT-B-119-ILL(2).

Descriptors: *Clams, *Calcium, *Inorganic compounds, *Biocontrol, *Metabolism, Biochemistry, Aquatic life, Aquatic animals, Chemcontrol, Inhibitors, Ion transport, Cations, Nutrients, Water quality, Chemical analysis, Membrane processes, Essential nutrients, Biology, Biological properties, Laboratory tests, Research and Development, Illinois.

The role of cytoplasmic calcium (Ca) concentration in producing lateral ciliary arrest was examined. Lateral cilia on the gill of the title fingernail clam normally have a metachronal rhythm beat. This rhythm is maintained or restored in the presence of 10.0 millimolar (mM) calcium chloride, or 15 mM potassium or sodium chloride. Lateral ciliary arrest occurred when the gill perfusion contained 10 mM calcium chloride and 0.01 mM (small clams) or 0.001 mM (large clams) of A23187, a calcium ionophore. Arrest was not produced in either calcium chloride or ionophore and monovalent cations alone. The results demonstrated the important role of intracellular Ca concentration on the behavior of lateral cilia. The physiological significance seems to be momentary or complete shut-down of water currents under unfavorable environmental conditions. The sensitivity to Ca membrane permeability appears to increase with age of animal. The clams were taken from Keokuk Pool of the Mississippi River. (Zielinski-IPA)
W81-01945

THE REGULATION OF INTRACELLULAR CALCIUM AND THE RELEASE OF NEUROTRANSMITTERS IN THE MUSSEL, MYTILUS EDULIS,
Southern Illinois Univ. at Carbondale.
A. Paparo.
Comparative Biochemistry and Physiology, Vol 66A, p 517-520, 1980. 10 Fig, 15 Ref. OWRT B-119-ILL(7).

Descriptors: *Electric currents, Biochemistry, *Calcium, Mode of action, Organic compounds, *Nutrient requirements, *Mussels, Aquatic life, Shellfish, Chemcontrol, Metabolism, Inhibitors, Biocontrol, Biology, Biological properties, Inorganic compounds, Ion transport, Cations, Nutrients, Essential nutrients, Chemical analysis, Ions, Aquatic animals, Membrane processes, *Mytilus edulis.

Electrical stimulation of the bronchial nerve has been shown to activate lateral cilia by release of cilio-excitatory 5-hydroxytryptamine (5-HT). This nerve also appears to contain axons with 3, 4-dihydroxyphenylethylamine (DA) which functions as an inhibitory neurotransmitter. The present study examined the effect of calcium (Ca) on endogenous and exogenous presence of the 5-HT and DA neurotransmitters. Lateral ciliary activity (CA) was studied on isolated visceral ganglion/bronchial nerve/gill preparations of this mussel. Bronchial nerve stimulation with 5 pulses/second (PPS) and 5-HT perfusion each accelerated ciliary beating; stimulation with 50 PPS and DA perfusion each inhibited CA. A decrease in external free Ca ion concentration or interference with Ca membrane permeability blocked nerve stimulation (low and high frequency), and subsequent endogenous release of neurotransmitters. Exogenous application of 5-HT and DA was not blocked by manipulation of Ca concentrations or Ca membrane interactions. It was concluded that Ca plays a critical role in regulation of presynaptic nerve terminal release of 5-HT and DA. (Zielinski-IPA)
W81-01946

CILIO-INHIBITORY EFFECTS OF BRONCHIAL NERVE STIMULATION, DOPAMINE, PENTYLENETETRAZOLE AND VISIBLE LIGHT IN THE MUSSEL, MYTILUS EDULIS,
Southern Illinois Univ. at Carbondale.
A. Paparo.
Comparative Biochemistry and Physiology, Vol 66C, p 249-253, 1980. 14 Fig, 21 Ref. OWRT B-119-ILL(6).

Descriptors: *Inhibitors, *Electric currents, *Calcium, *Biochemistry, *Mussels, *Mode of action, *Nutrient requirements, *Organic compounds, *Light shellfish, Aquatic animals, Metabolism, Biocontrol, Chemcontrol, Inorganic compounds, Ion transport, Cations, Nutrients, Chemical analysis, Ions, Aquatic life, Membrane processes, Laboratory tests, *Mytilus edulis.

Cilio-inhibition (CI) had been reported to occur in response to continuous stimulation of the bronchial nerve, manifested by a gradual decline in the rate of beating. It was recently shown that both high frequency and visible (490 nm) light release dopamine (DA) which leads to tranformations in yellow-carotino-protein (neuronal pigment), and that pentyleneterazole (PTZ) markedly depleted lipochondria of calcium (Ca). The present study sought to demonstrate whether high frequency (50 Hz), visible light, DA and PTZ produce CI by causing release of sequestered Ca from lipochrondia. Lateral ciliary activity was observed in intact and isolated cell preparations. High frequency electrical stimulation, DA, PTZ and visible light produced CI. CI produced by high frequency stimulation and photoactivation were blocked by ethylene glycol-bio(amino-ethyl ether)-N1,N2-tetracetic acid (EGBTA) and lanthanum. DA and PTZ caused a similar gradual CI as observed with high frequency stimulation and photoactivation, but DA and PTZ were not blocked by EGBTA and lanthanum. All of the CI agents studied seemed to increase cellular Ca concentration causing normal dense granules containing Ca to alter into membranous granules with subsequent release of Ca. (Zielinski-IPA)
W81-01947

HEAVY METALS AND MARINE DIATOMS: INFLUENCE OF DISSOLVED ORGANIC COMPOUNDS ON TOXICITY AND SELECTION FOR METAL TOLERANCE AMONG FOUR SPECIES,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Lab.
N. S. Fisher, and D. Frood.
Marine Biology, Vol 59, No 2, p 85-93, 1980. 2 Fig, 7 Tab, 66 Ref.

Descriptors: *Heavy metals, *Diatoms, *Resistance, Copper, Zinc, Cadmium, Organic compounds, Toxicity, Aquatic plants, Metals, Chelation, Water pollution effects, Marine plants, Phytoplankton, Corio Bay(Australia), Hobson's Bay(Australia), Bass Strait(Australia), *Australia.

Clones from diatoms living in waters chronically contaminated with heavy metals were generally less tolerant of copper, zinc, and cadmium additions than clones from the same species living in cleaner waters. Organic compounds dissolved in the 'dirty' water mediated the toxic effects of the metals. 'Dirty' water clones were especially subject to metal toxicity when in 'clean' water which contained low levels of dissolved organic compounds. Four species were tested in the heavy metal contaminated waters of Corio Bay, Australia, and of the relatively clean water Bass Strait. Copper was the most highly chelated and toxic; cadmium the least chelated and toxic. (Cassar-FRC)
W81-01978

EPIPELIC ALGAL COMMUNITIES IN A EUTROPHIC NORTHERN LAKE CONTAMINATED WITH MINE WASTES,
Alberta Environmental Center, Vegreville.
J. W. Moore.
Water Research, Vol 15, No 1, p 97-105, January, 1981. 2 Fig, 3 Tab, 32 Ref.

Descriptors: *Algae, *Water pollution effects, *Mine wastes, Water pollution, Eutrophication, Biological communities, Lakes, Heavy metals, *Lake sediments, Canada, Subarctic, Bioindicators, *Eutrophic lakes, Canada, Thompson(Alberta).

The impact of contaminated sediments on the density, species composition and diversity of benthic algal communities was examined in a small lake (Thompson Lake) located in the Canadian subarctic. Investigations were carried out at different sampling stations from April to November of 1978. Sediments in this shallow, eutrophic lake had become contaminated with wastes from gold mining activities on the southeast shore which were conducted from 1941 to 1949. Near the former mine site, total mercury, copper, lead and zinc averaged 440, 85, 30, and 115 milligrams/kilogram, respectively, but their concentrations decreased rapidly as distance from the mine increased. At distances of 2.1-3.0 km from the mine, levels of these metals were similar to background readings. Algal densities in the areas of heaviest contamination were only 50% of those found in other sites of the lake. Differences were also noted in the main species of algae found near the mine zone and algae sampled at stations 1.1-3.0 km away. Seasonal growth patterns were generally uniform throughout the lake. It was concluded that long term effects of mine wastes on epipelic algae were possible in northern aquatic systems and were similar to those observed in temperate zone lakes. However, no species or group of species could be designated as bioindicators of lake pollution by heavy metals. (Geiger-FRC)
W81-01982

CHANGES IN THE DENSITY OF ZOOPLANKTON PASSING THROUGH THE COOLING SYSTEM OF A POWER-GENERATING PLANT,
Australian Atomic Energy Commission, Sutherland.
R. D. Simpson, and A. Dudaitis.
Water Research, Vol 15, No 1, p 133-138, January, 1981. 3 Fig, 3 Tab, 12 Ref.

Descriptors: *Zooplankton, *Aquatic populations, *Cooling water, Copepods, Water temperature, Australia, *Electric powerplants, Water cooling, Water pollution sources, *Ecology, Environmental effects, Mollusks, Non-consumptive use, Intakes, Outlets.

Since zooplankton are important organisms in aquatic food chains, the effects of electric power plant cooling systems on these aquatic species have been investigated. A method was devised to sample the number and species types of plankton throughout the water column at the inlet and outlet of a power generating plant cooling system to determine if differences occurred as a result of cooling water intake operations. The technique was applied at a New South Wales coastal power station which is situated on a lake system consisting of Lake Munmorah and Lake Tuggerah, with an outlet to the sea. Specimens of copepods, copepod nauplii, barnacle nauplii, and bivalve larvae were collected by raising and lowering a net sampler through the water column. No significant changes in copepod densities were recorded after passage through the cooling system. Copepod nauplii and bivalve larvae became less abundant and barnacle nauplii more abundant after passage through the cooling system. These findings were attributed to the great rate of attachment of barnacles (which produce the nauplii) to both the inlet and outlet canals and the upsetting of copepod nauplii and bivalve larvae by the mechanical action of the pumping units. (Geiger-FRC)
W81-01986

RESPONSES OF SUBMERSED VASCULAR PLANT COMMUNITIES TO ENVIRONMENTAL CHANGE,
East Carolina Univ., Greenville, NC. Dept. of Biology.
G. J. Davis, and M. M. Brinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-164923, Price codes: A05 in paper copy, A01 in microfiche. Fish and Wildlife Service, Biological Services Program Report FWS/OBS-79/33, August, 1980. 79 p, 9 Fig, 4 Tab, 136 Ref, 2 Append. 14-16-0009-78-032.

Descriptors: *Submerged plants, *Aquatic plants, *Aquatic environment, *Light, *Turbidity, Eutrophication, Light penetration, Water pollution effects, Secchi disks, Depth, Lakes, Photosynthesis, Light intensity.

Submersed vascular plants are native to many aquatic ecosystems where they influence a number of ecosystem processes and provide food and shelter for fish and wildlife. The response of submersed vascular plants to the following environmental conditions was reviewed: fluctuating water levels, currents and waves, suspended sediments, growing season, dormancy, nutrient availability, plant-animal interactions, and light conditions. Data were assembled on depth distribution records of submersed angiosperms and the Secchi transparencies of water for mostly North American lakes. Laboratory and field studies generally show that most shade tolerant species have a rapid photosynthetic response to increasing light in the low range of intensities. In clear shallow waters, the competitive advantage is shifted toward species in which photosynthesis is saturated only by extremely high light intensities. Further analysis of depth distribution patterns of species and water transparency allowed identification of turbidity tolerant and non-tolerant species. Based on long term studies of northern lakes, a survival index for submersed species was developed. The possible effects of human activities on alterations in aquatic ecosystems and an array of impacts on submersed plant communities are considered. (Moore-SRC)
W81-02013

FEEDING IN ZOOPLANKTON,
C. H. D. Magadza.
The Zimbabwe Rhodesia Science News, Vol 13, No 7, p 163-164, July, 1979.

Descriptors: *Africa, *Eutrophication, *Zooplankton, *Aquatic algae, Chydorus, Daphnia, Scenedesmus, Microcystis, Nutrients, Lake stages, Biomass, Particle size, Microorganisms, Water pollution.

The hypothesis that one possible result of increased nutrient levels in water is the formation of algal colonies which are too large for filter feeding zooplankton was tested using cultures of Daphnia and Chydorus. Both single and mixed algal populations were exposed to the animals to determine the various size ranges that they are capable of filtering. A Coulter Counter was used to determine algal number and particle size. Chydorus was able to cope with particles ranging from 2 to just under 4 microns with small particles being preferred. Chydorus was almost unable to filter a culture of Scenedesmus which has a size range of 12 to 30 microns. Daphnia preferred particles ranging from 15 to 25 microns. A mixed population of Chydorus and Daphnia were also exposed to Microcystis, an algae causing major problems in Lake Mcllwaine in Africa. Both animals were unable to utilize Microcystis to any significant degree. The broad impressions of these preliminary results support the pattern of increasing algal numbers and declining zooplankton numbers in eutrophic waters. (Seigler-IPA)
W81-02058

WATERBORNE DISEASE: OCCURRENCE IS ON THE UPSWING,
Health Effects Research Lab., Cincinnati, OH.
E. C. Lippy
Journal of the American Water Works Association, Vol 73, No 1, p 57-62, January, 1981. 2 Fig, 2 Tab, 9 Ref.

Descriptors: *Public health, *Epidemiology, *Diseases, *Water pollution, Human diseases, Potable water, Recreation, Sewage effluents, Water purification, Chlorination, Water quality, Water pollution sources, Brevard, North Carolina, Lake Havasu City, Arizona, Bradford, Pennsylvania, Coliforms, State parks, Water wells, Beavers, Septic tanks.

Deficiencies in water treatment practices and plant operation were the causes of three outbreaks of waterborne disease during 1979. Beavers infected with giardiasis were the source of an epidemic of diarrheal illness affecting at least 2900 people in Bradford, Pennsylvania. Antiquated, inadequate chlorination equipment allowed nonchlorinated water to be delivered during 15 minute cylinder changes. In addition, sampling for residual chlorine was done too near the injection point, giving misleading high readings and resulting in low doses of chlorine. In this case, all components of the multiple barrier system had failed. After many visitors to the Cattail Cove State Park at Lake Havasu City, Arizona, became ill, dye tests revealed a connection between the sewage effluent plant and the potable water system. Since the same type and color of pipe was used for the effluent irrigation system as for the potable water supply and 4 owners modified the system during 6 years, conditions were optimum for contamination. This case points out the fact that regulatory agencies frequently neglect non-community systems, which often need the most attention. The Wilds, a church camp in Brevard, North Carolina, closed after widespread gastrointestinal illness occurred. Although dye tests showed no connection of broken septic tanks and other possible sources of sewage contamination to the water supply, it was believed that channels in the limestone had become clogged, preventing the dye from entering during the test. This was an example of difficulty encountered in using untreated water. Waterborne disease outbreaks totaled 45 in 1979. Average outbreaks per year in the past were 36 during 1976-1979, 24 during 1971-1975, and 10 during 1951-1955. (Cassar-FRC)
W81-02075

EUTROPHICATION IN EMILIA-ROMAGNA COASTAL WATERS (NORTH ADRIATIC SEA, ITALY): A CASE HISTORY,
Instituto di Ricerca Sulle Acque, Brugherio (Italy).
G. Chiaudani, R. Marchetti, and M. Vighi.
Progress in Water Technology, Vol 12, No 1, p 185-192, 1980. 7 Fig, 3 Tab.

Descriptors: *Sea water, *Eutrophication, *Benthic fauna, *Phosphorus, *Water pollution effects, Nitrogen, Coasts, Rivers, Water quality, Fertilizers, Farm wastes, Europe, Italy, Mediterranean.

Eutrophication phenomena in the Emilia-Romagna coastal area of the Mediterranean were found to be caused by phosphorus pollution. The distribution of nutrients in area waters was determined. The

area receives a total of 19,000 metric tons of phosphorus and 152,000 metric tons of nitrogen from various sources. The distribution of these nutrients matched the distribution of algal biomass. Diatoms developed in the northern areas near the mouth of the Po River. Dinoflagellates bloomed in strictly coastal waters. A strategy to prevent eutrophication is presented. Total phosphorus could be reduced to 5% of its present level if 95% of urban, zootechnical, and industrial wastes were removed and if fertilizers were used more sparingly. The study took place in 1976-78. (Small-FRC)
W81-02086

MICROCOSM SYSTEM STUDY OF ALGAL BLOOM FORMATION,
National Inst. for Environmental Studies, Yatabe (Japan). Lab. of Freshwater Environment.
M. Okada, and R. Sudo.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 1029-1034, May, 1980. 8 Fig, 12 Ref.

Descriptors: *Cyanophyta, *Eutrophication, *Microcosm studies, *Algae, Laboratory studies, Biomass, Diurnal, Microcystis aeruginosa, Microcystis flos-aquae.

To overcome the complicating factors of field studies and the oversimplification of laboratory studies, a microcosm system, intermediate between the two, was devised to study algal blooms. The system consists of Microcosm A, 2 tanks, and Microcosm B, 5 tanks, with associated tanks, pipelines, control systems, sterilizing equipment, computer, etc. Microcosm A is used for studying the photic zone and B for the aphotic zone. It is possible to alter growing conditions to simulate thermoclines, Langmuir circulation, air-water gas exchange, and diurnal variations. Growth curves for Microcystis aeruginosa were obtained at different depths (0.3 meters to 3.0 meters) without thermal stratification. On the 20 to 27th days, a bloom was present on the surface, followed by a sudden collapse. Similar studies on Microcystis flos-aquae with thermal stratification showed an algal biomass 10 times greater in the upper layers compared with the deeper layer. Rates of population growth were significantly less than in flask culture. Although little diurnal variation of dissolved oxygen was observed, a large vertical change was seen, and the concentration at a depth of 2 meters was 2 mg per liter. (Cassar-FRC)
W81-02095

THE LOADING CONCEPT AS BASIS FOR CONTROLLING EUTROPHICATION: PHILOSOPHY AND PRELIMINARY RESULTS OF THE OECD PROGRAMME ON EUTROPHICATION,
Canada Centre for Inland Waters, Burlington (Ontario).
R. A. Vollenweider, and J. Kerekes.
Progress in Water Technology, Vol 12, No 2, p 5-38, 1980. 6 Fig, 3 Tab, 31 Ref.

Descriptors: *Eutrophication, Control, *International commissions, *Data collections, Phosphorus, Lakes, Mathematical models, North America, Europe.

A major cooperative program involving 18 countries and including more than 50 research centers was developed to provide a sufficiently large body of comparable data to permit the derivation of quantitative relationships between loading and eutrophication of lakes. The four projects which make up the program are: an alpine project, a northern project, a reservoir and shallow lake project, and a North American project. Standard parameters for measuring and monitoring eutrophication have been established. One preliminary result is a confirmation that in 70 to 80% of the cases studied so far, phosphorus was found to be the production-controlling factor. A relationship is being studied between lake phosphorus levels and loading estimates, and Dillon's and Vollenweider's models are presented. (Small-FRC)
W81-02121

MARINE STUDIES ON A COASTLINE WITH SEWAGE OUTFALLS,
Techniche Eliminazione Inquinamenti, Milan (Italy).
P. G. Vigliani, B. Sclavi, A. Visconti, and G. F. Tartaglia.
Progress in Water Technology, Vol 12, No 1, p 145-162, 1980. 11 Fig, 5 Tab.

Descriptors: *Water pollution effects, *Outfall sewers, *Sewage, *Sea water, *Water properties, Water quality, Phytoplankton, Benthic fauna, Coliforms, Biochemical oxygen demand, Chemical oxygen demand, Turbidity, *Italy, Mediterranean.

A 90 km long section of the Italian coast with five existing sewage outfalls was investigated to determine the short and long term effects of discharges on the environment. Sea water and sewage/water mixtures were tested for current velocity and direction, depth, temperature, turbidity, dissolved oxygen, silicates, chlorides, salinity, pH, suspended solids, BOD5, COD, nitrogen, phosphates, oils and greases, coliforms, benthos, and phytoplankton. Measurements were made during periods of normal and maximum pollution load. Minimum initial dilutions measured at the plumes were 1:19 for the outfall Anzio Capoluogo, 1:25 for Torvaianica, 1:43 for Nettuno, and 1:65 for Anzio Bottaccio. The concentration of dissolved oxygen around the plume was also close to or greater than saturation, and entrapments of the discharge almost never occurred. Bacteria die-off rates in the sewage/sea water mixture averaged T90 of 1.65 hr and a minimum of approximately 1 hr. The minimum time of return-to-shore varied from 0.7 hr to 3.1 hr. Benthic and phytoplankton studies indicated that the pollution had a slight effect on the ecosystem of the area. (Small-FRC)
W81-02126

EFFECT OF CONSTRUCTION AND USE OF A HARBOR-INDUSTRIAL COMPLEX ON THE DISTRIBUTION AND EVOLUTION OF THE BENTHIC POPULATION OF A MEDITERRANEAN GULF (GULF OF FOS). (INFLUENCE DE LA CONSTRUCTION ET L'EXPLOITATION D'UN COMPLEXE PORTUAIRE ET INDUSTRIEL SUR LA DISTRIBUTION ET L'EVOLUTION DES PEUPLEMENTS BENTHIQUES LITTORAUZ D'UN GOLFE MEDITERRANEEN (GOLFE DE FOS)),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
G. Stora, and J. C. Romano.
Progress in Water Technology, Vol 12, No 1, p 137-144, 1980. 3 Fig, 8 Ref.

Descriptors: Sedimentology, *Benthic fauna, Sewage, *Excavation, *Construction, Effects, *Industrial wastes, Bioindicators, *Harbors, Water pollution sources, Gulf of Fos, *Mediterranean.

The effects of the construction and operation of a harbor and industrial complex on the benthic fauna of the Gulf of Fos were studied from 1964 through 1978. Construction (1964-1972), which included digging of the harbor, caused sedimentary instability, and only a few benthic species were found. In 1975, three years after the last construction work, species adapted to silting bottoms had replaced benthic fauna originally found in the area. There was an increase in pollution indicator species, indicating that the expected degradation of the environment had occurred. The sewage from the harbor and industrial complex are added to the sewage already in the Gulf, resulting in more Gulf pollution. (Small-FRC)
W81-02130

PREDICTION OF THE CALCIUM CARBONATE SATURATION PH IN COOLING WATER,
Houston Univ., TX. Dept. of Civil Engineering.
L. M. McGaughey, and J. V. Matson.
Water Research, Vol 14, No 12, p 1729-1735, December, 1980. 5 Fig, 5 Tab, 16 Ref.

Descriptors: *Mathematical studies, *Cooling water, *Calcium carbonate, Computer models, Model studies, *Hydrogen ion concentration, Industrial wastes, Equations, Waste water, Minerals, Salinity, Sulfates, Ions.

In 1936, the Langelier pHs equation was formulated to estimate the pH at which a water would be in equilibrium with CaCO3. A mathematical study was performed to quantify the extent of ion association in waters typical of open recirculating cooling systems, to derive a theoretical term for the Langelier pHs equation to explain significant calcium complexation, and to develop a method to amend the original Langelier equation to bring it in line with current theory. A computer model was used to solve the simultaneous equations describing the industrial cooling water systems investigated. When sulfate levels were approximately 1000 ppm, the calculated pHs was considerably altered. To correct for this, a predictive technique was proposed, wherein a system would be operated at a higher pH or at the same pH with higher calcium concentrations. The first option offers economic savings by reducing acid consumption, while the second option would afford reduced waste water production by maintaining higher dissolved mineral levels. The proposed correction should offer accurate results for pH ranges of 6.5-9.7 and ionic strengths of up to 0.5 M. (Geiger-FRC)
W81-02135

A STEADY STATE EUTROPHICATION MODEL FOR LAKES,
Iowa Univ., Iowa City. Dept. of Civil (Environmental) Engineering.
J. L. Schnoor, and D. J. O'Connor.
Water Research, Vol 14, No 11, p 1651-1665, November, 1980. 9 Fig, 2 Tab, 28 Ref.

Descriptors: *Eutrophication, *Model studies, *Northeast U.S., *Lakes, Great Lakes Region, *Lake Ontario, Mathematical models, Hydrolysis, Sedimentation rates, Phosphorus, Nutrients, Water management, Kinetics, Mathematical studies, Phytoplankton, LBJ Lake, Texas.

An alternate approach to eutrophication modeling is presented which simplifies assumptions of the kinetic and transport equations. Both steady and non-steady state cases were studied for LBJ Lake, Texas (a short detention time reservoir) and Lake Ontario (a long detention time reservoir). Steady state solutions are also given for 81 of the phosphorus-limited lakes of the US National Eutrophication Survey. Use of the model requires the estimation of the sedimentation, hydrolysis, autocatalytic growth, and death rate constants. The sedimentation rate constant determines the amount of phosphorus lost to the deep sediment, and the total phosphorus levels of the lake. The other three constants control the partitioning of nutrients among the various organic, inorganic, and phytoplankton fractions. In the lakes sampled in the northeast and north central United States, phytoplankton accounted for 10-40% of the total phosphorus, while dissolved phosphorus was 35-75% and organic phosphorus 0-40% of the total. The steady state model was recommended for use as a management tool when detailed analyses are not practical. (Geiger-FRC)
W81-02139

EFFECT OF INDUSTRIAL POLLUTION ON THE KALU RIVER ECOSYSTEM,
Institute of Science, Bombay (India). Environmental Chemistry Lab.
G. N. Mhatre, S. B. Chaphekar, I. V. R. Rao, M. R. Patil, and B. C. Haldar.
Environmental Pollution, Series A: Ecological and Biological, Vol 23, No 1, p 67-78, September, 1980. 2 Fig, 4 Tab, 19 Ref.

Descriptors: *Water pollution effects, *Industrial wastes, *Aquatic life, Pollutants, Water quality, Kalu River, *India.

In an effort to understand the effects of industrial effluents on estuarine ecosystems, water samples were taken from the Kalu River. This river originates in the Western Ghats, later reaching the Bhatsai River and then the Ulhas River near Kalyan, an industrial suburb of Bombay. The combined river flows for about 45 km further, receiving effluents from more than 150 industrial units before it meets the Arabian Sea. The major differ-

ences between water quality at Ambivali and that at Titwala, 8 km upstream, were accounted for by the discharge of effluents from four industrial plants at Ambivali. Aquatic life was severely hindered at Ambivali, with the water contaminated by both inorganic and organic pollutants including metals, chlorides, dyes, organic acids and others. Toxic heavy metals were studied in detail both in the water and in the sediments along the route. Sediments contained high levels of toxic metals at both Ambivali (which was expected) and Titwala (which was unexpected). The diversity of aquatic plants in the intertidal region at Ambivali was low compared with that at Titwala. Algae were abundant at Titwala, but hardly any were found at Ambivali. (Baker-FRC)
W81-02145

STEADY-STATE OSCILLATION OF UPTAKE KINETICS BY MICROORGANISMS IN MESOTROPHIC AND EUTROPHIC WATERMASSES,
Tsukuba Univ., Ibaraki (Japan). Inst. of Biological Sciences.
H. Seki, T. Terada, and S. Ichimura.
Archiv fur Hydrobiologie, Vol 88, No 2, p 219-231, March, 1980. 4 Fig, 20 Tab, 12 Ref.

Descriptors: *Kinetics, *Eutrophication, *Cycling nutrients, Amino acids, Carbohydrates, *Japan, Nitrogen, Seasonal, Fluctuations, Municipal wastes, Environmental effects, Rivers, Temperature, Mesotrophy, Aquatic microorganisms, Bays.

Michaelis-Menton kinetics were used to measure the in situ amplitude of steady-state oscillations in the microorganisms of the Inohzawa River, Shimoda Bay and Kuroshio Counter Current. These three sites were affected directly or indirectly by municipal waste discharges of Shimoda City, Japan. Bioassays conducted during all four seasons showed that turnover rates of the amino acids and carbohydrates are divided without regard to seasonal changes by thresholds among a mesotrophic watermass of the Kuroshio Counter Current and a eutrophic watermass of Shimoda Bay. The kinetics of the Inohzawa River were classified as eutrophic. Turnover rates suggested that the steady-state oscillations occurred in a certain range divided by the thresholds. Evidence was also present which indicated regulation of the oscillations by inorganic nitrogen with a negative feed-back system similar to that found in vivo. Temperature had little effect on the steady-state oscillations of the area. (Geiger-FRC)
W81-02148

5D. Waste Treatment Processes

FEASIBILITY OF ON-SITE DENITRIFICATION OF WASTE WATER BY SEPARATION OF GREY AND BLACKWATER,
Connecticut Univ., Storrs. Inst. of Water Resources.
R. Laak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173916, Price codes: A02 in paper copy, A01 in microfiche. Technology Transfer Report, 1981. 6 p. OWRT-A-999-CONN(19), 14-34-0001-0107.

Descriptors: *Denitrification, *Waste water, *Nitrification, *Waste water treatment, Greywater, Blackwater, Separation techniques, Filters.

A condominium complex with eight separate systems and a private residence were used to study the feasibility of on-site denitrification of waste water by separating grey and blackwater. The condominium complex denitrification reactors and groundwater quality could not be sampled due to leakages and temporary access difficulty. However, laboratory studies and the private residence verified that greywater is a suitable and feasible organic carbon source for the denitrification step. The most difficult step was found to be the nitrification filter design. Conventional subsurface underdrain filters need to be redesigned to yield optimal nitrification of the blackwater. The passive denitrification system called the RUCK system requires no more maintenance and operation than a conventional septic tank system. The RUCK effluent far surpasses conventional septic tanks and package plan effluent quality.
W81-01901

COMBINED SEWER SYSTEM ANALYSIS USING STORM AND SWMM FOR THE CITY OF CORNWALL,
Gore and Storrie Ltd., Ottawa (Ontario).
J. C. Anderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173858, Price codes: A11 in paper copy, A01 in microfiche. In: Proceedings, Stormwater Management Model (SWMM) Users Group Meeting, 19-20 June, 1980, Toronto, Ontario, Environmental Protection Agency Report EPA 600/9-80-064, December, 1980, p 1-22. 7 Fig, 4 Tab.

Descriptors: *Combined sewers, *Storm water, *Model studies, *Sewage disposal, Canada, Waste storage, Overflow, St. Lawrence River, Water pollution, Interceptor sewers, Treatment facilities, Hydraulics, *Cornwall(Ontario).

In the City of Cornwall, Canada, the flow from combined sewers is intercepted through regulator chambers, designed to intercept 2.5 times dry-weather flow. All flows exceeding this amount are discharged directly to the St. Lawrence River. At present, the plant is operating in an overloaded condition, and high bacteria levels have been measured at swimming beaches along the river shore. The Storage Treatment Overflow Model (STORM) was used to screen a number of control alternatives, and develop statistics with respect to system operation for various levels of both storage and treatment capacities. Subsequently, the Storm Water Management Model (SWMM) was used to assess selected control alternatives under individual event operation. After the STORM model was calibrated and modified for local conditions, a simulation of the system operation was undertaken over a period of one year, comparing both volume of overflow and number of events to those actually measured. Control alternatives considered include: various levels of treatment plant capacity expansion in-system storage, diversion of storm flows from the combined sewer system, improvements in street sweeping practices and industrial flow control or abatement. The most promising alternative is some combination of storage and treatment. SWMM was used to assess the hydraulic operation of the interceptor sewer under individual event operation with the easterly overflows closed and the entire wet weather flow intercepted. (Moore-SRC)
W81-01922

THE APPLICATION OF E.E.C. BATHING WATER STANDARDS TO THE DESIGN OF SEA OUTFALLS,
Dundee Univ. (Scotland). Dept. of Civil Engineering.
J. A. Charlton.
Progress in Water Technology, Vol 12, No 1, p 369-382, 1980. 6 Fig, 16 Ref, 1 Append.

Descriptors: *Waste dilution, *Dispersion, *Outfall sewers, Ocean currents, Tidal effects, Waste water treatment, Tracers, E. coli, Mediterranean, United Kingdom.

Survey and outfall design methods which have been successful in high and low tidal activity areas surrounding the United Kingdom are described. The direct discharge of macerated and screened sewage through a carefully designed outfall can meet the current E.E.C. bathing water standards. Water movement in the area of a proposed outfall must be measured using current metering or float and drogue tracking. Radioactive tracers or fluorescent dyes can be used for dispersion studies. A long term analysis of the wind climate can aid in the assessment of bacterial levels within the effluent plume. The possibility of a thermocline and the problem of low tidal energy are considered if the area under study is in the Mediterranean. The method of discharge will be influenced by these factors. For example, it may be necessary to release the sewage at a level above the thermocline so that effluent is not trapped below the surface where ultraviolet light cannot aid in reduction of bacteria (E. coli). (Small-FRC)
W81-01958

MODELLING THE BIOCHEMICAL OXIDATION PROCESSES IN ARTIFICIAL CONDITIONS OF WASTE TREATMENT PLANTS,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. A. Vavilin, V. B. Vasiliev, and S. S. Kuzmin.
Ecological Modelling, Vol 10, No 2, p 105-137, July, 1980. 7 Fig, 7 Tab, 81 Ref.

Descriptors: *Model studies, *Waste water treatment, *Oxidation, Mathematical models, Activated sludge, Monod's model, Grau's model, Ammonia, Glucose, Organic wastes.

Models for the biochemical oxidation of organic materials in waste water treatment plants are compared. Waste treatment models in activated sludge systems or biofilm reactors can be explained by either the diffusion mechanisms of oxidation of single substrates or by superimposition of the kinetics of oxidation of single substrates onto measurements of the dynamics of oxidation of a complex pollutant. In a multicomponent substrate the rate of oxidation of sewage water depends on number, type, and concentration of the single substrate; characteristics of sludge and biofilm; and hydrodynamic characteristics of liquid flow. Grau's and Monod's models are similar, with one coefficient to be determined in Grau's model and two in both Grau's refined model and Monod's model. This paper derives the conditions under which zero- and first-order models are valid for oxidation of single substrates, and gives formulas for rate constants and a formula for the half-saturation constant. Experimental data on glucose and ammonia agreed satisfactorily with data calculated from the model. (Cassar-FRC)
W81-01976

DETERMINATION OF HYDROLYTIC ACTIVITIES IN WASTE WATER SYSTEMS BY MICROCALORIMETRY,
Innsbruck Univ. (Austria). Hygienisches Inst.
B. Redl, and F. Tiefenbrunner.
Water Research, Vol 15, No 1, p 87-90, January, 1981. 5 Fig, 14 Ref.

Descriptors: *Biodegradation, *Anaerobic digestion, *Microcalorimetry, Kinetics, Sludge digestion, Metabolism, Carbohydrates, Proteins, Analytical techniques, Monitoring, Thermodynamic behavior, Testing procedures, Waste water treatment, Biological treatment, *Waste water facilities.

A method is described for the evaluation of hydrolytic processes in waste water systems by isothermal microcalorimetry. The adaptation of the degradation system to a particular substrate was measured in terms of net heat production. Samples examined included supernatant from the sludge drainage from a sludge densifier, a digested sludge taken from a digestion tank, a sludge taken from a digested sludge storage area, and water from the collecting basin of a garbage dump. Heat fluxes were recorded for the actions of samples on substrates of cellobiose, starch, skim milk, carboxymethylcellulose (CMC), and olive oil, and thermograms of heat effects over a 30-hour period were compared. Supernatant from sludge drainage was able to degrade all of the samples added to it within a 20 hour period. Cellobiose and starch were consumed much more slowly by the digested sludge samples from the sludge storage area, and CMC and olive oil were not hydrolyzed at all by this system within the observation period. In the basin water system, cellobiose was degraded more rapidly than CMC or starch. It was deemed possible to draw conclusions about the degree of degradation on the basis of the total amount of heat produced. The method permits direct and continuous monitoring of microbial activity and is particularly well adapted to anaerobic conditions. (Geiger-FRC)
W81-01984

VOLATILE ORGANIC ACIDS IN RAW WASTE WATER AND IN PHYSICO-CHEMICAL TREATMENT,
Technion - Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
N. Narkis, S. Henefeld-Fourrier, and M. Rebhun.
Water Research, Vol 14, No 9, p 1215-1223, September, 1980. 5 Fig, 7 Tab, 16 Ref.

Descriptors: *Organic acids, *Volatility, *Waste water treatment, Sewage, Sewage treatment, Chemical precipitation, Chemical analysis, Chemical degradation, Flocculation, Activated carbon.

The composition of volatile acids in raw sewage and the content of each individual acid was studied. Haifa municipal sewage and fresh residential sewage from Neveh Shaanan were sampled. The age of the municipal sewage at the point of sampling is estimated to be 6-12 hr. The age of the residential waste water at the collection point is 10-60 min. The percentage of volatile acids was much higher at the municipal treatment plant than in the residential waste water. Experimentation proved that the concentrations of acetic, propionic, butyric and isovaleric acids increase on storage at room temperature and in a refrigerator. Smaller changes were also noted in butyric and isovaleric acids, while valeric acids remained constant. Hexanoic acid was not detected. Extensive anaerobic decomposition takes place in the Haifa region sewage due to longer flowing time. (Baker-FRC)
W81-01990

SEPARATION OF LINDANE FROM ITS AQUEOUS SOLUTIONS BY REVERSE OSMOSIS SYSTEM,
Health and Welfare Canada, Ottawa (Ontario). Health Protection Branch.
M. Malaiyandi, P. Blais, and V. S. Sastri.
Separation Science and Technology, Vol 15, No 7, p 1483-1488, August, 1980. 2 Tab, 13 Ref.

Descriptors: *Pesticides, *Water purification, *Reverse osmosis, Waste water treatment, Membrane processes, Potable water, *Lindane, Water pollution, Osmosis, Water treatment.

Lindane at trace levels partially crossed a cellulose acetate reverse osmosis membrane. Another portion of the pesticide was adsorbed onto the membrane and slowly released into the product water. Since reverse osmosis water purifying systems are used extensively to produce high quality water for electronics and medical use, the possiblity of such water contamination should not be overlooked. After treatment, 36 and 24 + or - 1% of the initial quantities of lindane were found in recycled feed and product solutions, respectively, leaving 40% unaccounted for and presumed adsorbed on the membrane. Repeated washing of the membrane with water and ethanol removed 10% of the total. Destructive testing of the membrane indicated that a major portion of lindane was tenaciously adsorbed. (Cassar-FRC)
W81-01996

VOLATILIZATION, PLANT UPTAKE AND MINERALIZATION OF NITROGEN IN SOILS TREATED WITH SEWAGE SLUDGE,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
L. E. Sommers, C. F. Parker, and G. J. Meyer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173940, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 133, February, 1981. 64 p, 23 Fig, 24 Tab, 74 Ref. OWRT B-084-IND(1).

Descriptors: *Sludge utilization, *Sewage sludge, *Crop response, *Sorghum, *Ammonia volatilization, Sludge disposal, Land treatment, Water pollution, Ammonia, Nitrogen, Activated sludge, Anaerobic digestion, Nitrogen mineralization, Soil treatment, Application methods, Impaired water use.

Field and laboratory experiments were conducted to quantify the amount of ammonia volatilization taking place after application of sewage sludge to the soil surface, evaluate the movement of nitrogen and plant uptake from soils treated with sewage sludge, and determine the potential N mineralization in a wide range of sewage sludges. Volatilization of NH sub 3-N was found to be dependent upon the method of sludge application, initial soil moisture content and sludge pH. Sorghum plants recovered 7 to 27% of the total sludge N while the recovery of the total N ranged from 8 to 33% considering the N in the soil to a depth of 90 cm. Significant losses of sludge inorganic N occurred within 3 days of application. The amount of mineralizable N in 24 sewage sludges was found to be proportional to the total organic N content. The results of the study demonstrated the need to use a different N mineralization percentage for the various sludge types. Recognizing the limitation of the study, the recommended N mineralization percentage to use in calculating the appropriate sludge application rate for agronomic crops is 25% for raw and primary sludges, 40% for waste activated sludges, 15% for anaerobically digested sludges and 8% for composted sludges.
W81-02009

SLIMES CONSOLIDATION AT THE HENDERSON MINE,
Bureau of Mines, Spokane, WA. Spokane Research Center.
R. H. Sprute, and D. J. Kelsh.
Available from Supt. of Documents, GPO, Washington, DC 20402, No. I28. 23: 8441. Bureau of Mines Report of Investigations, 8441, 1980. 20 p, 9 Fig, 3 Tab, 5 Ref.

Descriptors: *Waste treatment, *Mine wastes, *Dewatering, *Mine water, Colorado, *Slime, Settling basins, Zeta potential, Electrophoresis, Electro-Osmosis.

Underground accumulations of slimes in the Henderson molybdenum mine are routed to two large collection pits where they are dewatered and consolidated by application of direct electrical current. Densified material is then removed to ore cars by rubber-tired front-end loaders and transported out of the mine. The electrical dewatering installation is described and its efficiency of operation compared with that predicted from preliminary studies performed by the Bureau of Mines. Direct current from a 150 kilowatt rectifier (applied for 44 hours at 400 amperes and 65 to 70 volts) converted slimes containing 25.3% solids to material ranging from 44 to 65% solids. Better results can be expected if the ramp and front sections of the pits are treated separately, using higher current density. The sump design and mode of operation should be generally applicable to other underground metal mines, following preliminary laboratory tests. (Brambley-SRC)
W81-02014

EFFLUENT CAN BE EXPENSIVE.
Imiesa (Johannesburg), Vol 4, No 5, p 9, 57, May, 1979. 1 Fig.

Descriptors: *United Kingdom, *Water pollution, *Effluents, *Water reuse, Recycling, *Waste water treatment, Industrial wastes, Pollution abatement, Water authorities, Flocculation, Spillage, Oil wastes, Water costs.

A United Kingdom company, West Midlands Passenger Transport Executive, has installed a water recycling system to treat its effluent from the washing of engines, refuse disposal vehicles, and buses. The company was prompted to do this due to the increasing costs of effluent treatment by water authorities. The recycling system is marketed by Concept Cleaning Equipment and, since its installation, has solved the company's discharge problem and reduced the volume of clean water needed. Before entering the main recycling plant the effluent goes through a screen. Next it is treated by electrolysis to separate the solids into flocs. An upward flow of water causes most of the flocs to settle to the bottom. After skimming the water flows through nylon bags and a carbon filter. Final recycled water has a pH of 7 with suspended solids of 6.5 ppm. The system requires careful operation and maintenance to keep water quality high. (Seigler-IPA)
W81-02045

SOLID LIQUID SEPARATION BY FILTRATION -- A REVIEW.
The Professional Engineer (Pretoria), Vol 7, No 2, p 9-10, April, 1978. 1 Fig.

Descriptors: *Filtration, *Separation techniques, *Water purification, *Filters, Centrifugation, Water quality, Sands, Rapid gravity filters, Liquids, Suspended solids, *Water treatment, Reviews.

Filtration, the production of a clear liquid or of the particles suspended in the liquid, has many industrial process applications, however, the largest application is for water purification. Deep sand bed filtration of water has been substantially developed. More recent developments have been made with rapid gravity filters, where filter cleansing is particularly important. Although many accessories exist for rapid gravity filters, it is quite feasible to filter water effectively without them. Suspended solids clarifiers are considered an essential precursor to filtration. Clarification and rapid gravity filtration now form the basis for water purification. A wide variety of filters exist for the filtration of industrial liquids such as beverages, oils, ores, minerals, and pharmaceuticals. The plate and frame filter is generally used for beverage filtration. Vertical tank, horizontal leaf filters are also used for beverage filtration and for food polishing. Other industrial filtration methods include candle filters, vacuum filters, centrifuges, and ion exchange separation. (Seigler-IPA)
W81-02048

URBAN WASTE WATER POLLUTION CONTROL IN SOUTH AFRICA.
Johannesburg City Engineer's Dept. (South Africa).
E. J. Hall.
Imiesa (Johannesburg), Vol 4, No 6, p 44-45, June, 1979.

Descriptors: *South Africa, *Waste water(Pollution), *Urban hydrology, Waste water disposal, Eutrophication, Sludge treatment, Water quality standards, Water quality, *Waste water treatment, Industrial water, Urban drainage, Solid wastes, Research and development, Water Act No. 54.

A semi-arid climate with cyclic drought patterns has forced South Africa to emphasize high standards of waste water purification to safeguard river water quality. As evidence of this emphasis, Johannesburg installed its first major sewerage system in 1904, and constant improvements have been made since then. In 1956 the Water Act No. 54 was enacted and superseded all earlier legislation. It enshrined the country's water resources as a national asset to be under the control of the Department of Water Affairs. While the Act sets standards, no financial grants or subsidies are made and each local authority must bear the full costs of compliance with the Act. This policy has made industries water-conscious and has encouraged recycling. Active research at all levels is an important feature of waste water control. The South African Council for Scientific and Industrial Research and the National Institute for Water Research coordinate these activities. Current areas of concern include eutrophication, sludge treatment, and solid waste disposal. South Africa can claim that it has not been backward in progress made with its major, but limiting resource, water. (Seigler-IPA)
W81-02059

DESIGN OF DECHLORINATION UNITS FOR POWER PLANT COOLING STREAMS,
California Univ., Davis. Dept. of Chemical Engineering.
C. Tan, S. Whitaker, and A. Berker.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 299-309, February, 1980. 11 Fig, 11 Ref.

Descriptors: *Waste water treatment, *Electric power industry, *Cooling water, *Chlorination, Turbulent flow, Utilities, Pollutants, Chemical reactions, Chemical engineering, Water pollution control, Water treatment, Effluents, Industrial wastes, Biocides, *Dechlorination, Model studies.

A simplified model for solving the turbulent diffusion equation for multiple injection points is presented to aid in design of dechlorination units for once-through power plant cooling streams. In these systems sulfurous acid is reacted with the hypochlorous acid formed from the biocidal chlorination process to form very dilute hydrochloric and sulfuric acids, which are discharged into a nearby river. Since the available reaction time is often less than a minute, mixing and chemical reaction rates are important. Thus smaller, multiple injection points have advantages over a larger single point. This equation relates the available length of the mixing channel to the number of injection points and the dose of sulfurous acid. In most cases a calculated overdose of sulfurous acid produces the best results. (Cassar-FRC)
W81-02084

LEAD REMOVAL WITH ADSORBING COLLOID FLOTATION,
Vanderbilt Univ., Nashville, TN.
E. L. Thackston, D. J. Wilson, J. S. Hanson, and D. L. Miller, Jr.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 317-328, February, 1980. 3 Fig, 3 Tab, 47 Ref.

Descriptors: *Lead, *Flotation, *Froth flotation, Heavy metals, Metals, Waste treatment, *Waste water treatment, Industrial wastes, Pilot plants, Flocculation.

Lead was removed from waste water in batch and continuous-flow studies of a flotation process. Batch experiments (lead concentration 50 mg per liter) showed that the optimum pH was 6.5, and that increasing ionic strength was detrimental. Above 4,250 mg per liter sodium nitrate, the separation efficiency dropped off noticeably. Ferric hydroxide proved to be a more effective adsorbing floc than aluminum hydroxide. Sodium hydroxide was a better neutralizing agent than sodium carbonate. Pilot plant studies using a flotation column 30 cm in diameter and 244 cm long were successfully conducted with a synthetic waste water containing lead at 20 mg per liter. pH control was the most acute operating problem. A 0.25 molar sodium hydroxide solution proved to be the optimum neutralizing agent. Optimum operating parameters for the 30-cm column were as follows: pH, 6.0-7.0; ferric hydroxide concentration, 100-150; sodium lauryl sulfate detergent, 35-40 mg per liter; hydraulic loading rate, 150-180 cu meters per sq meter per day; and air flow, 24-30 cu meters per sq meter per hour. If the effluent contained a high concentration of ions, a pH lower than 6.0 was more efficient. Field testing on waste water containing zinc, copper, and a variety of other materials produced interferences from phosphates and silicates. Subsequent refinements of the process produced effluents with 0.05 mg lead per liter at costs amounting to 50% of those of the traditional lime precipitation method. (Cassar-FRC)
W81-02085

MINIMIZING SLUDGE HANDLING AND ENERGY REQUIREMENTS FOR ADVANCED WASTE WATER TREATMENT,
Turnipseed (G. Ben), Inc., Atlanta, GA.
G. B. Turnipseed, R. P. Rivinus, and J. Brown.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 364-371, February, 1980. 7 Fig, 4 Tab.

Descriptors: *Sludge treatment, *Sludge disposal, *Waste water treatment, *Ultimate disposal, Engineers estimates, Planning, Water pollution control, Disposal, Methane, Pilot plants, Fertilizers, Nitrification, Biological oxygen demand, Estimated costs, Energy conservation, *Cobb County(GA), Georgia.

Several alternatives for sludge treatment at the proposed Noonday Creek Water Pollution Control Plant, Cobb County, Georgia, were considered in response to increasing sewerage needs and more stringent effluent requirements. Particular attention was given to minimizing sludge handling and energy costs. The rotating bio-disk system was chosen for the wet-treatment process. The system for solids treatment and disposal included thickening, digesting, dewatering, and heat drying/pelletization with subsequent sale as a fertilizer-soil conditioner. Pilot plant studies for the proposed plant indicated final design hydraulic loading rates of 1.1 gal per day per sq foot. 70% suspended solids and 30% influent BOD will be removed by primary clarification. Aluminum sulfate was the most effective chemical precipitating agent. Chemical costs for alkalinity adjustment during nitrification were estimated at $765 per day for sodium aluminate/alum and $645 per day for alum only. Methane gas from sludge digestion will be used to supply building heat and sludge heat, producing an annual energy savings of $32,000. Total annual sludge handling costs were estimated at $120 per ton, less $27 per ton income from selling the fertilizer product. Construction costs will be about $16 million. (Cassar-FRC)
W81-02087

PREDICTION OF ALKALINITY CHANGES IN THE ACTIVATED SLUDGE PROCESS,
Virginia State Dept. of Health, Danville.
S. N. Scearce, R. W. Benninger, A. S. Weber, and J. H. Sherrard
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 399-405, February, 1980. 5 Fig, 6 Tab, 12 Ref.

Descriptors: *Activated sludge, *Waste water treatment, *Nitrogen compounds, *Alkalinity, Nitrification, Nitrates, Ammonium compounds, Hydrogen ion concentration.

Nitrification causes a pH drop during activated sludge waste water treatment, requiring constant addition of alkalinity to maintain optimum conditions. Differences between the theoretical (7.14 mg per liter as CaCO3) and observed values of alkalinity destroyed per unit nitrate formed prevent accurate pH adjustments. Therefore, the authors propose a formula based on the theory that mineralization of organic nitrogen can impart alkalinity to waste water: Change in alkalinity = 3.57 (Change in filtrate organic nitrogen - Synthesized nitrogen) - 7.14 (Change in nitrate nitrogen). At high ratios of COD to total Kjeldahl nitrogen (TKN) the microbial biomass uses a large proportion of TKN, leaving little available for nitrification and causing little destruction of alkalinity. Conversely, low COD:TKN ratios cause a large pH drop. As the TKN:ammonium nitrogen ratio increases, greater amounts of organic nitrogen become available, and greater alkalinity reduction can take place. (Cassar-FRC)
W81-02089

DIGITAL ON-LINE CLOSED-LOOP CONTROL FOR WASTE WATER TREATMENT OPERATION,
Metropolitan Denver Sewage Disposal District No. 1, CO.
J. K. Nelson, and B. B. Mishra.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 406-415, February, 1980. 6 Fig.

Descriptors: *Computers, *Sewage treatment, *Digital computers, *Automatic control, *Waste water treatment, Data processing, Data storage and retrieval, Control, *Denver, Colorado, Remote control, Instrumentation, Sludge, Manpower.

Actual operating experiences using a direct digital control system at the Metropolitan Denver Sewage Disposal District No. 1 are described. A dual, redundant, computer-based data acquisition and control system with remote input/output multiplexing is used for monitoring and direct digital control. There are 160 analog inputs, 46 analog control outputs, 4 analog display outfits, 550 discrete inputs, and 35 control outputs. Since January, 1977, the system has been successful in controlling influent flow split, primary sludge pumping, secondary influent pumping, return sludge flow, waste activated sludge control, digester feeding, and process quality parameter monitoring. This facility includes a 42 mgd primary treatment process and a 72 mgd high purity oxygen activated sludge process. Although only 10 persons are needed to properly operate the equipment, they are highly trained and paid, offsetting the savings from a reduction in the manpower previously needed. However, the system demonstrates efficiency, valid data collection and reporting, true real time process control, experimentation with advanced control techniques, and centralized control. (Cassar-FRC)
W81-02090

FILTERBELT PRESSING OF SLUDGE--A LABORATORY SIMULATION,
Chalmers Univ of Technology, Goeteborg (Sweden).
R. E. Halde.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 310-316, February, 1980. 9 Fig, 1 Tab, 6 Ref.

Descriptors: *Sludge treatment, *Filtration, *Waste water treatment, Dewatering, Filterbelt presses, Model studies, Laboratory equipment, Testing, Separation techniques.

A flexible laboratory piston press detected small differences in sludge dewaterability. Many variations of filterbelt pressings may be simulated by subjecting the sludge to repeated pressings at varied time and pressures according to the process being studied. In this experiment only double nips were investigated (25 sec, 65 sec; 45 sec each; and 65 sec, 25 sec) at combinations of pressures from 50 to 500 kPa. Best dewatering was obtained when the second nip was at least as long as the first. This press was also used to determine the effects of various conditioning operations on sludge dewaterability. Aluminum sulfate-treated sludge produced a cake containing 8% dry solids; ferric chloride, 8.5%; polelectrolyte, 11%; and lime, 23%. Conditions used were a sludge load of 1.3 kg dry solids per sq meter; pressure 100 kPa; time, 85 sec; and specific time of pressure increase, 0.15 sec per kPa. No shear was applied. (Cassar-FRC)
W81-02093

TRACE METALS AND ANAEROBIC DIGESTION OF LEACHATE,
British Columbia Univ., Vancouver.
R. D. Cameron, and F. A. Koch.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 282-292, February, 1980. 4 Fig, 10 Tab, 13 Ref.

Descriptors: *Metals, *Leachate, *Anaerobic digestion, Trace elements, *Landfills, Waste treatment, Biological treatment, Waste disposal, Biodegradation, Digestion, Aluminum, Barium, Cadmium, Mercury, Nickel, Zinc, Iron, Chromium, Copper, Lead, Manganese, Calcium, Magnesium, Potassium, Sodium, Heavy metals removal

Leachate from landfills was anaerobically digested at 29 to 38C to determine the effect of trace heavy metals on the process and to assess heavy metal removal. In a medium-strength leachate 81 to 96% of BOD was removed. Settled effluent BOD removal was 83, 91, and 97% for solids detention times of 5, 10, and 20 days, respectively. COD removal varied from 65 to 80%. Heavy metals did not affect the digestion process, even over a long term operation with high loading and short retention times. Metal removal efficiencies were greater than 85% for Al, Ba, Cd, Hg, Ni, and Zn; 80% for iron; 40-70% for Cr, Cu, Pb, and Mn; 30% for Ca; and less than 10% for Mg, K, and Na. Most of the metals were associated with the sludge solids, most likely as insoluble precipitates or organically-bound complexes. There are several advantages to using this process to biostabilize landfill leachates--low heat requirements, successful performance, and ability to handle high-strength leachates. Before returning the sludge to a landfill, it is important to determine the exact form of the metal

contaminants so they will not be rapidly released upon acidification. (Cassar-FRC)
W81-02094

WATER QUALITY CONVERSION MATRIX OF AEROBIC BIOLOGICAL PROCESSES,
Hokkaido Univ., Sapporo (Japan).
N. Tambo, and T. Kamei.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 1019-1028, May, 1980. 8 Fig, 6 Tab, 6 Ref.

Descriptors: Water quality, *Aerobic treatment, *Organic compounds, *Biological treatment, Activated sludge, *Waste water treatment, Water treatment, Water purification, Trickling filters, Industrial wastes, Chromatography, Sewage treatment, Biological oxygen demand, Chemical oxygen demand, Efficiencies.

A conversion matrix was designed to determine water quality in evaluation of aerobic biological water and waste water treatment processes such as the activated sludge process, self-purification of natural water, and biological slow sand filtration. Organic compounds under consideration were divided into 6 groups by gel chromatography, and the dissolved organic carbon was measured at 260 nm. The derived removal efficiencies were arranged in a 2 dimensional matrix with respect to group number, and the extent of removal from various samples was estimated. Fairly good agreement between predicted and observed values was obtained for a variety of waste waters and for acetic acid solution. Slow sand filtration of diluted raw waste water and secondary effluent had higher experimental values than predicted because of interaction with ammonia and organics in the filter. (Cassar-FRC)
W81-02096

OXYGEN UPTAKE AS A CONTROL PARAMETER,
Memphis State Univ., TN. Dept. of Civil Engineering.
H. A. Kharajian.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 823-824, April, 1980. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Oxygen requirements, *Activated sludge, *Control, Microorganisms, Nutrients, Equations, Design, *Sanitary engineering.

The use of oxygen uptake rates to control the activated sludge process is discussed. Energy and endogenous oxygen uptake was determined from batch experimental data, and as loading increased, endogenous oxygen demand increased and energy oxygen demand decreased. These trends can be attributed to the ability of the microorganisms to store food and utilize it whenever the exogenous source of food is depleted. The variation in oxygen uptake is a function of the utilization rate or food to microorganism ratio, which is controlled by the influent organic content and the mixed liquor suspended solids in the aeration basin. The Eckenfelder equation can be used to plot oxygen uptake. The use of this equation, the coefficients of which are not constants, in the control of activated sludge may not be warranted when the influent is variable and heterogeneous. It may cause further complication of control strategies. It may, however, be useful in the design stages. (Small-FRC)
W81-02098

DESIGN AND PERFORMANCE OF NIGHT SOIL TREATMENT PLANTS,
Institute of Public Health, Tokyo (Japan).
Y. Magara, D. Sugito, and K. Yagome.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 914-922, May, 1980. 4 Fig, 5 Tab.

Descriptors: *Sewage treatment, *Standards, Tertiary treatment, Anaerobic digestion, *Treatment facilities, Design, Domestic wastes, *Japan, Night soil.

In Japan, 89,959 kl/day of night soil is collected by vacuum trucks from offices and homes and treated at 1186 night soil treatment plants. Septic tanks are unusual in Japan, and public sewerage does not yet reach all of the population. Before a night soil treatment plant is built, the local government is required to prepare a basic plant construction program based on a per capita excretion of 1.4 liters of human waste per day. The monthly average BOD of the effluent must be lower than 30 mg/liter, suspended solids must be less than 70 mg/liter, and the coliform bacilli count must be lower than 3000/ml. The central government specifies design criteria for treatment processes capable of meeting these standards. Most existing plants use anaerobic and aerobic digestion activated sludge processes. Advanced treatment processes are often necessary to meet present standards. These include direct incineration, high organic loading activated sludge, biological denitrification, and an exclusive treatment process for collected sludge from night soil purification tanks. Good night soil treatment eliminates the use of conduits and conserves water, since flush toilets are not needed. Collected night soil treatment can add much to public health without significant costs. (Small-FRC)
W81-02099

MATHEMATICAL MODEL FOR IMPROVING COMBINED SEWER SYSTEMS,
Public Works Research Inst., Ibaraki (Japan).
For primary bibliographic entry see Field 4A.
W81-02104

ODOR CONTROL OF WASTE WATER TREATMENT PLANTS,
Japan Sewage Works Agency, Tokyo.
S. Ando.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 906-913, May, 1980. 2 Fig, 5 Tab.

Descriptors: *Odor, *Aeration, *Waste water treatment, Treatment facilities, Control, Pollution abatement, Japan.

Odor in Japan is regulated by the Offensive Odor Control Law, which provides for municipal ordinances against odor discharge. Out of 288 municipalities that have waste water treatment plants, 161 (71%) are regulated. Most waste water plants are covered completely or partially with a roof, which helps control odors. There are 129 deodorizing facilities which employ water scrubbing, activated carbon adsorption, ozonation, or acid scrubbing. Several examples are given of deodorizing facilities. At the Toyohiragawa plant in Sapporo City part of the odorous material is incinerated at high temperatures, and another portion is used as air in an aeration tank. At the Fukashiba plant odor from the grit chamber and pumping room is treated by activated carbon adsorption. Research is being conducted on methods of odor control, and new treatment methods are being investigated to control odor production. More than half of the complaints about plant odors are caused by aeration tanks of the diffuser type. Mechanical aeration or a pure oxygen process are possible alternatives. (Small-FRC)
W81-02105

WASTE WATER TREATMENT PLANTS AND POLICIES OF KYOTO,
Japan Sewerage Bureau, Kyoto.
T. Yoneda.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 978-984, May, 1980. 4 Fig, 4 Tab.

Descriptors: *Kyoto(Japan), *Sewerage, *Waste water treatment, Municipal wastes, Oxygenation, Activated sludge, Sludge disposal, Effluents, Water pollution, Japan.

The city of Kyoto, Japan, population 1.5 million, began construction of sewer facilities in 1930, suspended building during and after World War II, and by 1978 served 52% of its residents. Presently 3 treatment plants operate, discharging effluents into the Yodo River, which is a drinking water source for Osaka and Kobe. The Kisshoin plant started using a 20,000 cu meter per day oxygen system in September, 1977. This system is still undergoing evaluation and optimization. Sludge disposal is a problem for all the city's plants. Since 1973 sludge has been incinerated. Effluent quality is regulated by city ordinance, which is more stringent than national standards and requires pretreatment of discharges containing toxic metals. Progressive surcharges are imposed for waste water with BOD over 200 mg per liter. Present priorities include extension of the sewer system to a goal of 100% coverage. (Cassar-FRC)
W81-02106

DEVELOPMENT OF SEWER SYSTEMS AND TREATMENT PLANTS IN TOKYO,
Tokyo Metropolitan Government (Japan).
K. Terada.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 961-968, May, 1980. 2 Fig, 4 Tab.

Descriptors: *Tokyo, Japan, *Sewerage, *Waste water treatment, Aeration, Activated sludge, Sludge disposal, Water reuse, Tertiary treatment, Municipal wastes.

The history, status, and present problems of Tokyo's sewer system are described. The system, started in 1883, serves 70% of the 8.5 million population and a large industrial complex. The inner city is served by 8 waste water treatment plants, using the activated sludge treatment process, with a total capacity of 5,453,000 cu meters daily. Sludge, presently produced at the rate of 3,400 metric tons per year, was formerly dumped into Tokyo Bay and is now incinerated or used for land reclamation with and without mixing with cement. Present and future concerns are sludge disposal, public relations, reuse of effluent by industry and for cleaning, overload of the combined system during periods of high rainfall, implementation of deep aeration tanks, and tertiary treatment. (Cassar-FRC)
W81-02107

NAGOYA SEWERAGE PLAN,
Nagoya Municipal Government Dept. of Sewage Works (Japan).
M. Ozeki.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 969-977, May, 1980. 6 Fig, 3 Tab.

Descriptors: *Sewerage, *Nagoya(Japan), *Waste water treatment, *Municipal wastes, Activated sludge, Sludge disposal, Aeration, Japan.

The City of Nagoya, Japan, population 2.08 million, began sewerage planning in 1893. The old city area was equipped with pipes by 1923. Between 1930 and 1934 treatment plants were put into operation using activated sludge with diffused aeration. World War II destroyed much of the existing facilities, and recovery was not complete until 1953. Since this time, existing plants were improved and expanded, and additional ones were built. A new method of thickening, dewatering, and incinerating raw sludge was implemented, replacing the sandbed disposal method. Future plans include centralized sludge treatment and improvement of the quality of recycled wastes from sludge handling. Ocean dumping of sludge will increase as the quantity increases. Pollution and sewer overflow occurring during heavy rainfall will be remedied. (Cassar-FRC)
W81-02108

CONTROL OF INDUSTRIAL WASTE WATER IN OSAKA,
Japan Sewage Works Bureau, Osaka.
K. Nanbo.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 992-998, May, 1980. 2 Fig, 5 Tab.

Descriptors: *Industrial wastes, *Water pollution control, *Waste water treatment, Osaka, *Japan, Water quality control, Control, Regulation, Discharge(Water), Legal aspects.

This paper describes the industrial waste water situation in Osaka, Japan. Of the city's 33,839 factories, 94.5% have less than 30 employees. The total industrial waste water sewer input for 1978

was 339,801 cu meters per day. Regulations dictate that all waste water in a sewered area must be taken into the system unless otherwise designated. Certain specified factories may not discharge waste water into the sewer system unless it conforms with specified requirements. Some industries may be obliged to construct their own treatment facilities. Spot inspections by patrol groups are made at the rate of 2.1 inspections per year for each factory using pretreatment. The violation rate was 24.2%. The police also investigate compliance, and violators are regularly prosecuted. Future concerns are a study of colored waste waters, limiting COD to a reasonable level, a study of recycling and reuse technology, establishment of guidelines for safe sludge disposal, and continuous, automatic water analysis. (Cassar-FRC)
W81-02110

TANNERY WASTE WATER TREATMENT BY THE OXYGEN ACTIVATED SLUDGE PROCESS,
Japan Sewage Works Agency, Tokyo.
M. Kashiwaya, and K. Yoshimoto.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 999-1007, May, 1980. 1 Fig, 7 Tab.

Descriptors: *Design criteria, *Industrial wastes, Activated sludge, Oxygenation, *Tannery wastes, Pilot plants, Himeji, *Japan, Municipal wastes, *Waste water treatment.

Pilot plant studies testing the oxygen activated sludge process to treat tannery waste water defined the design criteria and operation conditions to reduce BOD5 to 20 mg per liter or less. Detention time at temperatures below 10C was reduced from 25 hours to 12 hours by combining the tannery waste water with municipal waste water. Two pretreatment plants have been built, in Himeji, Japan, one for 234 tanneries in the Takagi District and one for 99 in Shigo. All treated effluent will be further treated at the Tobu Waste Water Treatment Plant. Since tanneries are closed for holidays during several 10-day periods each year, a flow equalizer basin will be installed in the treatment plants. (Cassar-FRC)
W81-02111

CURRENT RESEARCH ON ADVANCED WASTE WATER TREATMENT IN JAPAN,
Japan Sewage Works Agency, Tokyo.
M. Kashiwaya, and T. Annaka.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 1008-1012, May, 1980.

Descriptors: *Waste water treatment, *Japan, *Research and development, *Pilot plants, Technology, Activated sludge, Eutrophication, Phosphorus compounds, Nitrogen compounds, Filtration, Organic matter, Nitrification, Conservation.

In Japan, 84 educational and research institutions were involved in sanitary engineering research as of 1978. Of the 576 projects performed, 254 concerned waste water treatment. Private industry also contributed many technical papers on waste water treatment. Some subjects under consideration are removal of organic matter in secondary effluents, removal and control of phosphorus and nitrogen, waste water reuse, sludge disposal with recovery of Al and P, improvement of biological processes and minimum use of chemicals, ultimate sludge disposal, combined sewer overflow control, watershed management, and trace toxicant control. Currently, the Public Works Research Institute of the Ministry of Construction is operating 3 pilot plants to study a variety of waste water treatment developments: phosphorus removal by chemical precipitation, ammonia removal by air stripping, on-site monitoring, and direct filtration of secondary effluent with inert dual media filters. The Japan Sewage Works Agency operates laboratory and pilot studies concerning oxygen activated sludge, rotating biological contactors, ultra-high rate chemical coagulation, and improvement of eutrophic Lake Biwa. Future research should be directed toward conservation of energy, resources, and land use. (Cassar-FRC)
W81-02112

DISINFECTION OF SECONDARY TREATED EFFLUENT WITH OZONE. (DISINFECTION DES EAUX RESIDUAIRES URBAINES PAR L'OZONE.),
SETUDE, Paris (France).
C. Gomella.
Progress in Water Technology, Vol 12, No 1, p 383-391, 1980. 1 Fig.

Descriptors: *Chlorination, *Ozonation, *Sewage treatment, Methodology, Coliforms, Disinfection, *France.

The disinfection of secondary treated effluent by chlorination and ozonation were compared. Filtered and unfiltered secondary effluent was disinfected by an economical method of ozonation. In the first stage of ozonation, a predetermined residual of ozone is obtained. In the second state, the required ozone residual is maintained for a required contact time. A four-fold reduction in total coliforms was obtained for non-filtered effluent by treatment with 8 g of ozone per cubic meter for a contact time of 9 minutes. For filtered effluent, the required dosage was 5 g of ozone per cubic meter for the same contact time. The same reduction in coliforms was obtained after chlorination of non-filtered effluent with 14 g/cu m for 13 minutes and filtered effluent with 10 g/cu m for 13 minutes. Ozonation improved the appearance, color, BOD, and COD, and had a slightly greater sterilizing effect on E. coli, fecal coliforms, streptococci, and salmonella than did chlorination. (Small-FRC)
W81-02116

STOCHASTIC APPROACH TO WASTE TREATMENT PLANNING,
Utah Water Research Lab., Logan
For primary bibliographic entry see Field 6A.
W81-02122

PREDICTION OF THE CONTAMINATION PRODUCED BY DISPERSION OF EFFLUENTS THROUGH OCEAN OUTFALLS. (PREDICCION DE LOS NIVELES DE CONTAMINACION PRODUCIDOS POR VERTIDOS REALIZADOS A TRAVES DE EMISARIOS SUBMARINOS.),
Ministerio de Obras Publicas, Madrid (Spain). Gabinete de Aplicaciones Nucleares.
For primary bibliographic entry see Field 5B.
W81-02129

ADVANCED WASTE WATER TREATMENT REMOVES NUTRIENTS WITHOUT CHEMICALS,
P. J. Leslie.
Water and Pollution Control, Vol 118, No 10, p 12-13, 27, 30, October, 1980.

Descriptors: *Nutrient removal, *Tertiary treatment, *Waste water treatment, Biological treatment, Phosphorus, Nitrogen, Sludge, Water quality, Water reuse, Nitrification, Denitrification, South Africa, Pilot plants, Temperature, Economics, Bardenpho process, Canada.

Work performed on biological nitrification/denitrification systems at waste water pilot treatment plants in South Africa has resulted in the development of a process (the Bardenpho process) for combined phosphorus and nitrogen removal without the use of chemical additions. The Bardenpho process has been adopted by many waste water treatment plants in Africa, South America and the United States. The method is economically advantageous over techniques requiring chemicals, while providing more than 90% removal of nitrogen and phosphorus under anoxic conditions. In the Bardenpho process the waste water passes through a primary and a secondary anoxic zone before undergoing reaeration and forced anaerobic fermentation. Sludges contain no added metal salts and may be applied to land as fertilizers. The effects of low temperatures on the Bardenpho process were examined in Canadian pilot plant studies, with results which indicated that this biological treatment could survive the cold Canadian winters. The adaptations of the process to water reuse programs are also considered. (Geiger-FRC)
W81-02132

MODELING AND PREDICTION OF SPECIFIC COMPOUND ADSORPTION BY ACTIVATED CARBON AND SYNTHETIC ADSORBENTS,
National Inst. for Water Research, Pretoria (South Africa).
B. M. van Vliet, W. J. Weber, Jr., and H. Hozumi.
Water Research, Vol 14, No 12, p 1719-1728, December, 1980. 6 Fig, 4 Tab, 19 Ref.

Descriptors: *Adsorption, *Activated carbon, *Mathematical models, Kinetics, Waste water treatment, Phenols, Organic wastes, Tertiary treatment, Water purification, Water treatment, Separation techniques, *Synthetic adsorbents.

Eight synthetic adsorbents and two commercially available activated carbons were examined for their ability to adsorb phenol as a model for removal of specific organics from waste water. Both the adsorption equilibrium or capacity and the mass transport kinetics of the organic in each adsorbent were considered. Data derived from finite-batch, batch-reactor equilibrium and kinetic studies was incorporated into the numeric-based predictive model for fixed-bed adsorber design. Independent experimental parameters obtained from fixed-bed adsorber runs were used to test the validity of model results. All of the isotherm data generated was mathematically described by a new empirical isotherm equation. Good agreement was achieved between the predicted and experimental breakthrough curves for the synthetic adsorbents, but for the two activated carbons, the two values agreed only about halfway through the curves, followed by a slower approach to equilibrium. Possible reasons for this latter effect, which was not explained by the present model, are discussed. The model is considered satisfactory for application to water and waste water treatment systems. (Geiger-FRC)
W81-02136

INACTIVATION OF F2 VIRUS WITH FERRATE (VI),
Miami Univ., Coral Gables, FL. Dept. of Civil Engineering
T. Schink, and T. D. Waite.
Water Research, Vol 14, No 12, p 1705-1717, December, 1980. 13 Fig, 3 Tab, 61 Ref.

Descriptors: *Disinfection, *Iron compounds, *Viruses, Chlorine, Viricides, E. coli, Resistance, *Waste water treatment, Water treatment, Organic compounds, Aquatic life, Environmental effects, Hydrogen ion concentration, Chlorination.

Potassium ferrate has been considered as a substitute for chlorine for the disinfection of water and waste waters. The effectiveness of ferrate (VI) as a viricidal agent against f2 virus has been tested in buffered, distilled water and secondary treated sewage effluent. The resistance of f2 virus and Escherichia coli to iron (VI) ferrate in buffered, distilled water was also studied. The inactivation of f2 virus was enhanced as pH decreased. In both pure and secondary effluent systems at concentrations of 1 ppm, potassium ferrate inactivated 99% of f2 virus in 22 minutes at pH 7.8, 5.7 minutes at pH 6.9, and only 0.77 minutes at pH 5.9. At pH 7.8, concentration of the disinfectant and time had equal effects. The resistance of f2 virus to potassium ferrate was the same as, or less than, that of E. coli inbuffered, distilled water at the pH levels tested. The disinfection reactions did not follow first order kinetics. The ferrate compounds were less affected than chlorine by changes in organic content, pH and temperature, while leaving no residual (as do halogenated disinfectants) to harm aquatic life. It was concluded that ferrate compounds would be good viricidal agents in raw and waste waters. (Geiger-FRC)
W81-02137

PHENOL AND FREE AMMONIA INHIBITION TO NITROSOMONAS ACTIVITY,
Pittsburgh Univ., PA. Environmental Engineering Program.

R. D. Neufeld, A. J. Hill, and D. O. Adekoya.
Water Research, Vol 14, No 12, p 1695-1703, December, 1980. 8 Fig, 2 Tab, 11 Ref.

Descriptors: *Nitrification, *Biological treatment, *Phenols, Model studies, Ammonia, Biodegradation, Microbial degradation, *Waste water treatment, Hydrogen ion concentration, Kinetics, Oxidation, Industrial wastes, Nitrite, Sewage bacteria, Respiration.

In a study designed to elucidate the possible causes of the biological nitrification process instability found in many industrial waste water operations, the rate of ammonia bio-oxidation to nitrite by an autotrophic culture of strict nitrifiers was examined. Laboratory tests were conducted using batch respirometric evaluations of Nitrosomonas cultures to quantify the effects of phenol and non-ionized (free) ammonia on biokinetic parameters. The nitrifying organisms used had been adapted to a synthetic ammonia waste, and received only inorganic carbon during the course of the experiments. Ammonia oxidation biokinetics followed Michaelis-Menten type relationships, while the influence of non-ionized ammonia on ammonia oxidation was best described by a 'substrate-inhibition' Monod kinetics model. This model accounted for observed differences in ammonia bio-oxidation as a function of pH. The Michaelis-Menten constant varied with the square root of the ambient phenol concentration. Engineering design and operational considerations for the biological removal of ammonia in waste water are also examined. (Geiger-FRC)
W81-02138

5E. Ultimate Disposal Of Wastes

MILL'S CONVERSION OF SOLID WASTE INTO FUEL YIELDS ENERGY SAVINGS.
Pulp and Paper, Vol 54, No 11, p 105-106, November, 1980. 1 Fig.

Descriptors: *Wood wastes, *Sludge disposal, *Incineration, Solid wastes, *Energy sources, *Fuel, Waste water treatment, Ultimate disposal, Pulp and paper industry, Industrial wastes, Abitibi-Price Co., Disposal, Waste disposal, Flotation, Water pollution treatment, Sewage lagoons, Lagoons, Settling basins, Sewage treatment, Bacteria.

Sludge from the Abitibi-Price Alpena, Michigan, hardboard mill is collected by dissolved air flotation, dewatered to a 15-25% solids content, dried to a 7-8% moisture content, and pelletized (average 1/8 inch diameter). These pellets are burned in combination with coal, saving 15% of the coal. The sludge is composed of dead bacteria which have digested the dissolved solids (essentially wood sugars) in the secondary treatment ponds. Although this procedure is a break-even proposition financially, elimination of the sludge disposal problem and improvement of environmental conditions are valuable benefits. (Cassar-FRC)
W81-01995

A GUIDE TO REGULATIONS AND GUIDANCE FOR THE UTILIZATION AND DISPOSAL OF MUNICIPAL SEWAGE SLUDGE.
Environmental Protection Agency, Washington, DC. Office of Water and Waste Management.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-108508, Price codes: A04 in paper copy, A01 in microfiche. Report EPA 430/9-80-015, September, 1980. 53 p, 1 Tab, 68 Ref. Pub. MCD-72 available from General Services Administration, Denver Federal Center, Denver, Colorado 80225.

Descriptors: *Municipal wastes, *Sludge disposal, *Legislation, *Waste treatment, *Ultimate disposal, Incineration, Impoundments, Landfills, Sludge treatment, Waste disposal, Treatment facilities.

This document is a supplement to the current EPA regulations and guidelines that need to be addressed, and the problems frequently encountered, when planning and operating a sewage sludge disposition (utilization and/or disposal) facility, and should aid in the selection and implementation of an appropriate disposition technique. Incineration, composting and surface impoundments are considered treatment and volume reduction methods, and landfilling, ocean disposal, land spreading, and distribution and marketing are considered ultimate utilization and disposal methods. Background information, applicable laws, regulations and guidelines, procedure needed for implementing the disposition method, problems frequently associated with the disposition method that are not covered by regulations and solutions to these problems, and references are provided for each disposition method. (Brambley-SRC)
W81-02012

MINIMIZING SLUDGE HANDLING AND ENERGY REQUIREMENTS FOR ADVANCED WASTE WATER TREATMENT,
Turnipseed (G. Ben), Inc., Atlanta, GA.
For primary bibliographic entry see Field 5D.
W81-02087

CONTROL OF MERCURY POLLUTION IN JAPAN AND THE MINAMATA BAY CLEANUP,
T. Ishikawa, and Y. Ikegaki.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 1013-1018, May, 1980. 1 Fig.

Descriptors: *Minamata Bay, *Japan, *Mercury, *Water pollution control, Bottom sediments, Waste disposal, Waste treatment, Disposal, Marine life, Water pollution effects, Sludge disposal, Water treatment, Ultimate disposal.

As a result of mercury poisonings in Minamata, Japan, in 1956 and 1965, strict effluent standards became mandatory in Japan. Effluents must contain no greater than detectable limits (0.0005 mg per liter) of total Hg or alkyl Hg. Industrial plants using Hg processes have largely converted to non-Hg processes. Limits for seafood were set at 0.3 mg per liter of methyl Hg and 0.4 mg per liter total Hg on a wet basis. Contaminated bottom sediments were removed in 33 of 42 specified sites by 1978. In Minamata Bay, sediment contains up to several hundred mg per liter Hg, probably as sulfides, in deposits 4 meters deep. Marine life is incurably poisoned. To avoid further water pollution by disturbing bottom sediments, plans for removal have been formulated. A temporary cofferdam will be built, into which the contaminated sediment will be pumped. Dredging will take place in this confined area. Methylation of mercury will be minimized by keeping the area flooded with sea water and protected from sunlight. Excess water will be purified before discharging. Marine life and water quality will be constantly monitored. This project, currently suspended under an injunction, is expected to take 10 years to complete. (Cassar-FRC)
W81-02097

HANDLING HAZARDOUS WASTE--AN UNSOLVED PROBLEM,
Environmental Defense Fund, Washington, DC.
For primary bibliographic entry see Field 5B.
W81-02146

5F. Water Treatment and Quality Alteration

THE CONTROL OF ANIMALS IN WATER MAINS USING PERMETHRIN, A SYNTHETIC PYRETHROID,
Essex Water Co., Maldon (England).
R. P. Mitcham, and M. W. Shelley.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 5, p 474-482, 1980. 5 Fig, 2 Tab, 7 Ref.

Descriptors: *Aquatic insects, *Pesticide toxicity, *Permethrin, Water quality, Public health, Diptera, Rainbow trout, Insecticides, Distribution systems, Population, Resistance, Laboratory tests, *Water treatment, Potable water, Gas chromatography.

When supplies of the natural pyrethrin insecticide were running low, the Langford treatment works began to test the synthetic pyrethroid insecticides, resmethrin, bioresmethrin and permethrin to control populations of chironomids in public water supplies. Permethrin toxicity to the larvae of the insect Paratanytarsus sp. and adults of Asellus aquaticus, certain domestic aquarium fish (guppies, platies, and neon tetras), and young trout (Salmo gairdneri) were examined in laboratory tests. Insects were exposed to permethrin dose levels ranging from 0.001 to 0.025 mg/liter. Aquarium fish were exposed to dechlorinated tap water containing permethrin at levels of 0.025 mg/liter. No mortality occurred in trout exposed to 0.025 mg/liter of permethrin; however, the presence of fish caused reductions in water levels of permethrin when compared to tanks containing the insecticide but no fish. This was attributed to removal of permethrin by active surfaces on the fish. No mortality was observed among the aquarium fish tested. Permethrin toxicity to the insects tested showed a dose dependent relationship, with rapid paralysis in Asellus adults and narcotic action to Paratanytarsus larvae, permitting effective flushing. Chemical analyses of permethrin levels in water were carried out by a single column gas liquid chromatographic technique, which is described. A three year monitoring program was conducted on water samples from southend water mains to assess the effectiveness of the insecticide treatment on aquatic insects. The four categories found in greatest abundance, the Paratanytarsus larvae, Cladocera, Nais and the Limnochares, were similar to those found when pyrethrin was used. Unlike pyrethrin, permethrin dosing of the water system has prevented reinfestations of the water supply even after 90 weeks. These findings show the increased effectiveness of this synthetic pyrethroid in controlling pathogenic chironomids, with no detrimental effects on fish. (Geiger-FRC)
W81-01905

PREVENTING HALOFORM FORMATION IN DRINKING WATER,
South Dakota School of Mines and Technology, Rapid City.
L. L. Harms, and R. W. Looyenga.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-144453, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-091, August, 1980. 101 p, 18 Fig, 16 Tab, 18 Ref, 11 Append. R805149-01-0.

Descriptors: *Potable water, *Distribution systems, *Trihalomethanes, *Chlorination, South Dakota, Water purification, Disinfection, Environmental sanitation, Water pollution, Pipes, Land use, Turbidity, Water properties, Specific conductance, Chloroform, *Huron(SD).

The Huron, South Dakota, water distribution system was monitored for trihalomethanes at several locations. Deposits from within the distribution system were evaluated as potential precursor material and were found to be precursors for the haloform reaction. Field tests designed to determine the extent of trihalomethane formation that occurs as a result of the pipe deposits were inconclusive. The deposits appear to be a precursor source, but they do not substantially alter the terminal trihalomethane concentration. Ammonium sulfate was used to convert to a combined chlorine residual in the distribution system. A significant drop in trihalomethane concentrations was obtained along with maintenance of adequate disinfection. Primary disinfection was obtained by lime softening followed by a free chlorine residual. Land used upstream from the raw water intake was evaluated for potential chloroform formation. Peak concentrations occurred near marshes, where cattle watered, and where the river was stagnant. Nine raw water quality parameters were monitored and correlated with trihalomethane formation. The best correlations were obtained with specific conductance and turbidity. (Author's abstract)
W81-01933

CENTRAL LINCOLNSHIRE SCHEME MOVES AHEAD.

Water Services, Vol 84, No 1016, p 623-624, October, 1980. 1 Fig.

Descriptors: *Water purification, *Potable water, *Lincolnshire(UK), *Saltersford(UK), Limestones, Water sources, Groundwater, Nitrates, Surface waters, Reservoirs, Water supply, *Water treatment.

Improvement of water supplies in central Lincolnshire was commenced in 1978 by connecting reservoirs to allow transfer of water during seasons of peak demand on the Central Limestone borehole sources. By 1982 the Saltersford Treatment Works, with a maximum capacity of 25,000 cubic meters per day, will be completed. The source of water supply will be surface waters. In addition, a main connecting the treatment works with the town of Lincoln will allow the Central Limestone groundwater sources to be removed from service during periods of adverse water quality. (Cassar-FRC)
W81-01956

REMOVAL OF ARSENIC FROM CONTAMINTED DRINKING WATER BY A CHITOSAN/CHITIN MIXTURE,
Saint Mary's Univ., Halifax (Nova Scotia). Dept. of Chemistry.
C. M. Elson, D. H. Davies, and E. R. Hayes.
Water Research, Vol 14, No 9, p 1307-1311, September, 1980. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Potable water, *Arsenic, *Ion exchange, *Water treatment, Chelation, Separation techniques, Chitin, Chitosan, Canada, Water wells, Copper, Sulfate.

The efficacy of a chitosan/chitin mixture in removing arsenic from natural waters was investigated. When flakes of chitosan were stirred with a water sample, the pH of the mixture increased from 6.7 to over 8 and the arsenic level in the water remained constant at 0.1 ppm. However, holding the pH of the sample to between 5.5 and 6.5 with additional acid allowed the arsenic concentration to be lowered by 80% after 150 minutes of stirring. Flakes of chitin stirred with a water sample caused the pH to be decreased by 2 units and removed 25% of the arsenic. The mixture of chitosan/chitin removed certain polyoxy-anions including arsenate from water at a neutral pH. The capacity of the mixture was about 0.1 mu mol/g, which is 10,000 times smaller than the capacity of commercial ion-exchangers. The arsenic was bound to the polymers by a combination of electrostatic, ion-exchange attraction and chelation. (Baker-FRC)
W81-01988

GEORGIA UNIVERSITY TEAM DEVELOPS WATER SYSTEMS GUIDE,
Georgia Inst. of Tech., Atlanta.
T. N. Debo, and H. Wanning.
Public Works, Vol 111, No 6, p 79-83, June, 1980. 6 Fig, 3 Tab, 1 Ref.

Descriptors: *Water treatment, *Potable water, *Local governments, *Publications, Georgia, Future planning, Water quality, Water resources development, Water management(Applied), Project planning, Universities, Water delivery, Costs, Water policy.

A coalition of members from Georgia's three leading universities - the Georgia Institute of Technology, the Georgia State University and the University of Georgia-was combined with a Local Government Advisory Committee to form an Inter-University Task Force (IUTF) to select and study local problems. During its first year in operation the IUTF opted to work on 'A Guide to Investments in Water Systems for Local Officials.' In 1977, revisions to the Safe Drinking Water Act of 1974 put the burden of providing safe and drinkable water supplies on the local governments. The costs for providing such potable water have increased in recent years due to inflation. The guide was designed to aid officials in analyzing future large-scale capital improvements or expansion of publically-owned water systems. The 240-page guide is composed of 13 chapters and 2 appendices. Topics include background on small water systems, treatment and distribution processes, checklists of performance criteria, planning for system improvements, rate schedules and metering policies, preventive maintenance programs, emergency procedures, recording systems, state and federal regulations, budgeting and finance, consulting services, and government aid agencies. The guide was directed to small towns with populations of 500-10,000 but may be applied to larger areas. The guide is not intended to replace the services of a civil engineer or water systems professional. (Geiger-FRC)
W81-01991

NEW YORK CITY'S PILOT PLANT FILTER STUDIES. PART TWO,
Metcalf and Eddy, Inc., New York.
G. P. Fulton.
Public Works, Vol 111, No 5, p 85-88, May, 1980. 6 Fig, 3 Tab, 1 Ref.

Descriptors: *Pilot plants, *Water treatment, *Filtration, Suspended solids, Turbidity, Data collections, Economics, Construction costs, Water supply, Flocculation, Settling velocity, Coagulation, Color, Water quality, Croton supply, New York City.

In part 2 of a two part report, data evaluation of information on New York's pilot plant filter studies being conducted on the Croton Supply is presented. The pilot tests proved to be well worth the investment, showing costs for a conventional plant based on the Ten-State Standards and a maximum filtration rate of 2 gpm per sq. ft. to be approximately $147 million. The costs of the pilot plant studies were nearly negligible in comparison with the potential savings of more than $14 million which represents the difference in construction costs of direct filtration and optimized conventional treatment. A unique ozone/diatomaceous earth filter process was also developed during the Croton study; this was effective in removing color and was more economical in construction costs than the granular process. The new procedure also showed economic advantages over conventional filtration during the settling step. The city of New York has decided to continue investigations into the ozone/diatomaceous earth process with larger scale facilities to refine design criteria, optimize efficiency through process and resource recovery measures, and determine adaptability to pending changes in the standards for organic constituents and disinfection. (Geiger-FRC)
W81-01993

PACKAGE WATER TREATMENT PLANTS. VOLUME 2. A COST EVALUATION,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
R. G. Stevie, and R. M. Clark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-102717. Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-008b, July, 1980. 75 p, 25 Fig, 7 Tab, 8 Ref, 3 Append.

Descriptors: *Water treatment, *Treatment facilities, *Cost-benefit analysis, Rural areas, Potable water, Water quality, Appalachian Mountain Region, Economics, Construction costs, Municipal water, Operating costs, Capital costs, Utilities, Recreational facilities, Kentucky, Tennessee, West Virginia.

Many small and rural water treatment systems have high unit costs because of the small number of service connections and they may have trouble meeting minimal drinking water standards. An alternative to conventional water treatment plants is the package water treatment plant, which is a self-contained unit. Data were collected for water quality and costs for 36 package plants, both municipal and recreational, in Kentucky, West Virginia and Tennessee. Utility costs were separated into four components: acquisition, treatment, distribution and support services. These plants can provide water that meets the turbidity requirements of the National Interim Drinking Water Standards. Scale economies are possible in package treatment plants treating under 1 million gallons per day and they can be used in a cost effective manner in small communities. (Brambley-SRC)
W81-02015

URBAN WATER SUPPLY -- A STATISTICAL SURVEY,
National Building Research Inst., Pretoria (South Africa). Building Services Div.
G. J. Malan
Municipal Engineer (Johannesburg), Vol 10, No 4, p 9-11, 13-14, 16-19, July/August, 1979. 36 Tab, 3 Ref.

Descriptors: *South Africa, *Water supply, *Statistical methods, *Surveys, Questionnaires, Measurement, Statistics, Piping systems(Mechanical), Water distribution(Applied), *Rhodesia, Design criteria, Distribution systems, Utilities, Water delivery.

The results of a questionnaire on reticulation networks and water supply in buildings were statistically analyzed to provide a basis of comparison for municipalities needing to access their own standards. The questionnaires were completed by 54 local water authorities in South Africa, South-West Africa, and Rhodesia. Questionnaire items under reticulation included the following: hydraulic design criteria, pipes and jointing for mains and service connections, corrosion protection, maintenance, pressure control, and installation. Items covered under supply to buildings included the following: metering, pipe sizing, materials, location, control, and fire fighting. Tables are used to show the number of replies giving each answer for each question. Certain aspects of urban water supply showed a general consensus. Inconsistencies in design and construction standards were also evident. Recommendations on certain practices are included. (Seigler-IPA)
W81-02054

NOTES AND COMMENTS: THE PROBLEM WITH PERFORATED BAFFLES,
W. Goodnow
Journal of the American Water Works Association, Vol 72, No 12, p 710, December, 1980.

Descriptors: *Baffles, *Settling basins, Flow, Basins, Flocculation, *Water treatment, *Kansas City, Kansas.

In a reply to a previous paper which stated that perforated baffles improve performance in rectangular settling basins, the author describes contrary results in a similar situation at the Kansas City, Kansas, Quindaro water plant. The perforated baffles caused poor distribution of flocculated water and degradation of large floc particles passing through the baffle perforations. These baffles were replaced with 13 manually adjusted pivoting vertical baffles, and basin performance improved. (Cassar-FRC)
W81-02069

RESPONSE OF LEAD SOLUBILITY TO DISSOLVED CARBONATE IN DRINKING WATER,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 5B
W81-02070

DESIGN OF AERATION TOWERS TO STRIP VOLATILE CONTAMINANTS FROM DRINKING WATER,
Montgomery (James M.), Inc., Washington, DC.
M. C. Kavanaugh, and R. R. Trussell
Journal of the American Water Works Association, Vol 72, No 12, p 684-692, December, 1980. 9 Fig, 6 Tab, 19 Ref.

Descriptors: *Aeration, *Organic compounds, *Water purification, Potable water, Water treatment, Trihalomethanes, Design criteria, Volatility.

Aeration using packed towers was used to remove trace organic contaminants such as trihalomethanes from drinking water. There are 4 main considerations in design of a packed tower: air-to-water ratio, superficial water velocity (and thus the column diameter), type of packing, and depth of packing. The designer must also consider the coldest air and water temperatures, physical chemistry of the contaminant, and mass transfer characteristics of the packing. The design procedure is illustrated by an example using chloroform as the contaminant. Packing material is chosen first, in many cases polypropylene or polyvinyl chloride with low packing factors, and then the number of transfer units, allowable gas flow, column diameter, height of unit, a constant (overall liquid mass transfer coefficient times interfacial area per volume of packing across which mass transfer occurs), packing height, and tower dimensions (1.5 times the calculated dimension for a safety factor) are added in. (Cassar-FRC)
W81-02071

RESERVOIR COATINGS CAN SUPPORT BACTERIAL GROWTH,
East Bay Municipal Utility District, Oakland, CA.
W. M. Ellgas, and R. Lee.
Journal of the American Water Works Association, Vol 72, No 12, p 693-695, December, 1980. 3 Fig, 1 Tab, 2 Ref.

Descriptors: *Protective coatings, *Storage tanks, *Bacteria, Water distribution(Applied), Coatings, Epoxy resins, Linings, Plastics, Rubber, Reservoir storage, Resins, Vinyl resins, E. coli, Water districts, East Bay Municipal Utility District, California.

An ideal potable water reservoir coating was not found in a study of 32 rubbers, vinyl resins, epoxy resins, polyurethanes, and other polymers. The most acceptable coating consisted of a 4-component vinyl resin system--primer, white undercoat, and 'final gray topcoat,' with 'gray topcoat' as the final layer. Coatings were tested for bacterial growth support on 4 species: E. coli, Enterobacter aerogenes, Klebsiella oxytoca, and Pseudomonas sp. In addition to bacterial considerations, the coating must not impart taste or odor to the water or contain excessive amounts of undesirable solvents. Problems in selecting coatings involve changes in bacterial growth potential as coatings cure and age, changes in manufacturer's formulations, and presence of toxic materials. (Cassar-FRC)
W81-02072

SUBMARINE TRANSMISSION LINE: LIFELINE FOR VIEQUES,
Puerto Rico Aqueduct and Sewer Authority, Hato Rey.
J. J. Mayol, and J. R. Goitia.
Journal of the American Water Works Association, Vol 72, No 12, p 678-683, December, 1980. 6 Fig.

Descriptors: *Water distribution(Applied), *Pipelines, Conduits, Water supply, Potable water, Submarine pipelines, Puerto Rico, Vieques, Conveyance structures, Closed conduits.

A submarine water transmission main from Puerto Rico to the island of Vieques, 10 miles away, insures an adequate, reliable supply of potable water for the island's 8,000 inhabitants. Inaugurated Feb. 10, 1978, this system was chosen as the most cost-effective over other alternatives--additional well-drilling, impoundment of surface runoff, and seawater desalinization. The main begins at the Puerto Rico Rio Blanco pumping station, runs 9,100 meters to a 12' diameter pipeline 3,600 meters long, and terminates at a 100,000 gal concrete tank 20 meters above sea level. The undersea section is 16' diameter lined carbon steel pipe 17,250 meters long and has a 17.2 meter difference in elevation from the Puerto Rico storage tank to the Vieques storage area, Arcadia reservoir. The pipeline does not follow a straight line under the water, because rock and coral formations interfere. Maximum depth of the pipeline is 17 meters. A 100,000 gal reservoir receives the water, which is pumped to a 250,000 gal concrete reservoir. Customers receive water by gravity through an existing pipe network. Funding, which totaled $13,901,820, was received from the Puerto Rican government, Farmer's Home Administration, and PRASA revenues. (Cassar-FRC)
W81-02073

RECENT DEVELOPMENTS IN FILTRATION SYSTEM DESIGN,
Montgomery (James M.), Inc., Pasadena, CA.
R. R. Trussell, A. R. Trusell, J. S. Lang, and C. H. Tate.
Journal of the American Water Works Association, Vol 72, No 12, p 705-710, December, 1980. 6 Fig, 8 Tab, 8 Ref.

Descriptors: *Design criteria, *Filtration, *Water treatment, Filters, Flocculation, Turbidity.

In determining water treatment plant filter efficiency, filtration rate and backwash volume can provide additional data to supplement the commonly used parameter, length of filter run. Effects of various variables on filter performance were determined in order to provide information for design considerations. Conventional filtration rates may be increased considerably without adversely affecting filter performance. On-off cycles should be limited to six per day to produce acceptable effluent. Angular filtration media perform more satisfactorily than smooth media. As the ratio of depth of the medium to diameter of the media particles increases, filter performance improves, but to a lesser extent than equations predict. Multimedia filtration produces effluent quality to that of similar dual media filtration, but requires shorter filter runs. (Cassar-FRC)
W81-02074

INACTIVATION OF F2 VIRUS WITH FERRATE (VI),
Miami Univ., Coral Gables, FL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W81-02137

5G. Water Quality Control

DISTRIBUTION METHODS FOR TRANSFERABLE DISCHARGE PERMITS,
Illinois Univ. at Urbana-Champaign, Dept. of Civil Engineering.
J. W. Eheart, E. F. Joeres, and M. H. David.
Water Resources Research, Vol 16, No 5, p 833-843, October, 1980. 7 Fig, 4 Tab, 5 Ref.

Descriptors: *Mathematical models, *Water permits, *Water rights, Model studies, Phosphorus, Discharge, Waste water treatment, Costs, Lake Michigan, Wisconsin, *Waste water disposal permits, *Effluent limitations, Water pollution control.

The policy of transferable discharge permits (TDP) is also known as the policy of pollution rights, marketable effluent permits and transferable residual permits. Under TDP policies, the agency charged with pollution control distributes permits allowing a certain quantity of a specified pollutant to be discharged. A mathematical model has been designed to simulate the operation of a single-price auction of TDP's. At the auction, the permits are sold by the controlling authority or are given away, free of charge, to the dischargers according to a pre-set formula. The TDP policies may be subsequently redistributed at a similar auction. A comparison of the sales method with four other free allocation schemes is presented for the hypothetical case of phosphorus discharge from point sources along the Wisconsin-Lake Michigan watershed. The first involves distribution of permits to municipal treatment plants in proportion to the average hydraulic load. The second allocates permits in proportion to the pollutant load. The third method distributes permits to waste water treatment plants in proportion to the total value of the property served by each treatment facility. The free distribution methods are more favorable for the dischargers. (Geiger-FRC)
W81-01960

ORGANICS; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates Inc., Washington, DC.
Environmental Protection Agency, Office of Water Regulations and Standards Report, October, 1980. 29 p, 57 Ref. WA-80-A055, 68-01-6058.

Descriptors: *Water quality control, *Water quality standards, *Polychlorinated biphenyls, *Phenols, *Aromatic-compounds, Federal jurisdiction, State jurisdiction, Legislation, Water pollution sources, Effluents, Toxicity, Phthalate esters.

This digest is intended as a general information resource containing excerpts from the individual Federal-State water quality standards for three organic compounds - phenol, phthalate esters and polychlorinated biphenyls (PCB's). The sources of these chemicals in water systems are given. Because of its toxicity and possible carcinogenicity the EPA has established a zero discharge PCB federal effluent standard for new and existing production facilities. The 1976 Quality Criteria for Water established the following water quality criteria recommendations: phenol - 1 microgram per liter; phthalate esters - 3 microgram per liter; and PCB - 0.001 microgram per liter. Individual criteria are presented for the states, for the District of Columbia, and for overseas jurisdictions. (Brambley-SRC)
W81-02016

INTERMITTENT STREAMS; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates Inc., Washington, DC.
Environmental Protection Agency, Office of Water Regulations and Standards Report, September, 1980. 16 p, 57 Ref. WA-80-A055, 68-01-6058.

Descriptors: *Water quality control, *Water quality standards, *Intermittent streams, *Critical flow, Aquatic life, Federal jurisdiction, State jurisdiction, Legislation, Water utilization, Channels, Pollutants, Low flow.

This digest is intended as a general information resource containing excerpts from the individual Federal-State water quality standards for intermittent streams. The EPA has recommended that water quality standards should protect specified uses of a waterway in critical low flow situations, and for intermittent streams, the Agency recommends that criteria be adopted to the extent necessary to assure that conditions in the streams or stream beds will not impair existing or designated uses in the stream or in downstream waters. The 1976 Quality Criteria for Water recommends pollutant criteria for the protection of aquatic life and other stream uses during the minimum stream flow, which in many cases is the average seven-day low flow which occurs once in ten years. Individual criteria are presented for the states, the District of Columbia, and overseas jurisdictions. (Brambley-SRC)
W81-02017

GENERAL PROVISIONS/FREEDOMS; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates Inc., Washington, DC.
Environmental Protection Agency, Office of Water Regulations and Standards Report, September, 1980. 35 p, 57 Ref. WA-80-A055, 68-01-6058.

Descriptors: *Water quality control, *Water quality standards, Water pollution effects, *Waterways, *Aesthetics, Aquatic life, State jurisdiction, Federal jurisdiction, Waste water(Pollution), Water pollution, Toxicity.

This digest is intended as a general information resource containing excerpts from the individual Federal-State water quality standards for general

provisions or freedoms. These are general and encompassing statements providing for the aesthetic beauty of a waterway, and are not based on scientific rationale. The 1976 Quality Criteria for Water recommends the following aesthetic qualities criteria. All waters should be free from substances attributable to waste water or other discharges that: settle to form objectionable deposits; float as debris, scum, oil, or other matter to form nuisances; produce objectionable color, odor, taste, or turbidity; injure or are toxic or produce adverse physiological responses in humans, animals, or plants; and produce undesirable or nuisance aquatic life. Individual criteria are presented for the states, for the District of Columbia, and for overseas jurisdictions. (Brambley-SRC)
W81-02018

NITROGEN-AMMONIA/NITRATE/NITRITE; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates Inc., Washington, DC.
Environmental Protection Agency, Office of Water Regulations and Standards Report, September, 1980. 18 p, 57 Ref. WA-80-A055, 68-01-6058.

Descriptors: *Water quality control, *Water quality standards, *Nitrogen compounds, *Inorganic compounds, Ammonia, Nitrates, Federal jurisdiction, State jurisdiction, Legislation, Toxicity, Water pollution sources, Nitrogen cycle, *Interstate rivers.

This digest is intended as a general information resource containing excerpts from the individual Federal-State water quality standards for ammonia, nitrate and nitrite nitrogen in interstate surface waters. The sources of each form of nitrogen in water are given. The rationale for establishing water quality criteria for these molecular forms of nitrogen are: (1) ammonia toxicity to aquatic life is well documented and its toxicity is directly dependent on the pH of the water in which it is dissolved; (2) growing plants assimilate nitrate and ammonium ions into plant proteins; and both nitrate and nitrite nitrogen are toxic to aquatic life where specific concentrations of either are reached in a waterbody. Individual criteria are presented for the states, the District of Columbia, and overseas jurisdictions. (Brambley-SRC)
W81-02019

PESTICIDES; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates, Inc., Washington, DC.
Environmental Protection Agency, Office of Water Regulations and Standards Report, October, 1980. 46 p, 57 Ref. WA-80-A055, 68-01-6058.

Descriptors: *Water quality control, *Water quality standards, *Pesticides, Pesticide residues, *Agricultural runoff, Federal jurisdiction, State jurisdiction, Legislation, Chlorinated hydrocarbon pesticides, Effluents, Water pollution sources, Herbicides.

This digest is intended as a general information resource containing excerpts from the individual Federal-State water quality standards for fifteen pesticides. The pesticides exert detrimental effects on aquatic and animal life; some are suspected mutagens or carcinogens. The EPA recommended ambient water quality criteria are listed for aldrin/dieldrin, chlordane, chlorophenoxy herbicides, DDT, demeton, endosulfan, endrin, guthion, heptachlor, lindane, malathion, methoxychlor, mirex, parathion, and toxaphene. Their presence in water may be the result of agricultural or forestry application or production facility effluents. Individual criteria are presented for the states, the District of Columbia, and overseas jurisdictions. (Brambley-SRC)
W81-02020

TEMPERATURE; WATER QUALITY STANDARDS; CRITERIA DIGEST; A COMPILATION OF STATE/FEDERAL CRITERIA.
Environmental Protection Agency, Washington, DC. Office of Water Regulations and Standards. Report, July, 1980. 71 p, 7 Tab.

Descriptors: *Water quality control, *Water quality standards, *Thermal pollution, Aquatic life, Fish, Federal jurisdiction, State jurisdiction, Legislation, Sea water, Fresh water.

This digest is intended as a general information resource containing excerpts from the individual Federal-State water quality standards for water temperature. The standards are set to control thermal pollution caused by the discharge of heated wastes into bodies of water. The 1976 Quality Criteria for Water recommends that to protect freshwater aquatic life there is an upper limiting temperature for short-term time-dependent exposures and a limit on the weekly average temperature. To protect marine aquatic life the maximum increase in weekly average temperature due to artificial sources may not exceed 1C and the daily temperature cycle may not be altered in amplitude or frequency. Individual criteria are presented for the states, for the District of Columbia, and for overseas jurisdictions. (Brambley-SRC)
W81-02021

ANTIDEGRADATION POLICIES; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates, Inc., Washington, DC
Environmental Protection Agency, Office of Water Regulations and Standards Report, October, 1980. 44 p, 57 Ref. WA-80-A055, 68-01-6058.

Descriptors: *Water quality control, *Water quality standards, *Water resources, Thermal pollution, Federal jurisdiction, State jurisdiction, Legislation, Water utilization, Water quality, Natural resources, Water properties.

This digest is intended as a general information resource containing excerpts from the individual Federal-State water quality standards for antidegradation policies. The EPA recommends that each state adopt an antidegradation policy into its water quality standards. The key concepts to be included as minimum requirements are (1) in all cases, existing instream beneficial stream uses must be maintained, (2) high quality waters must be maintained unless the State decides to allow limited degradation where economically or socially justified (limited degradation is permitted to the extent at which water quality criteria necessary to sustain the national water quality goals uses are maintained); (3) outstanding national resource waters must be maintained and protected and; (4) thermal discharge limitations, as specified under Section 316(a) of the Clean Water Act as amended in 1977, will be considered to be in compliance with this policy. Individual criteria are presented for the states, the District of Columbia, and overseas jurisdictions. (Brambley-SRC)
W81-02022

OTHER ELEMENTS; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates Inc., Washington, DC.
Environmental Protection Agency, Office of Water Regulations and Standards Report, October, 1980. 23 p, 57 Ref. WA-80-A055, 68-01-6058.

Descriptors: *Water quality control, *Water quality standards, *Trace elements, *Metals, Aquatic life, Toxicity, Federal jurisdiction, State jurisdiction, Legislation, Water pollution sources, Irrigation water, Mollusks, Salmonids, Domestic water, Barium, Beryllium, Boron, Chlorine, Manganese, Nickel, Selenium, Silver.

This digest is intended as a general information resource containing excerpts from the individual Federal-State water quality standards for eight elements usually incorporated into State Water Quality Standards. The elements are barium, beryllium, boron, chlorine, manganese, nickel, selenium, and silver. Some sources of these elements in water are given. The EPA's recommended ambient water quality criteria to protect aquatic life and human health are given for each element for the waters for which they have been established. Criteria have been established for barium in domestic water supplies, beryllium in freshwater and irrigation waters, boron in irrigation waters, chlorine for salmonid fish and other freshwater and marine organisms, manganese in domestic water supplies and for protection of consumers of marine mollusks, nickel for freshwater and marine aquatic life, and selenium and silver in domestic water supplies and for marine and freshwater aquatic life. Individual criteria are presented for the states, for the District of Columbia, and for overseas jurisdictions. (Brambley-SRC)
W81-02023

PHOSPHORUS; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates, Inc., Washington, DC.
Environmental Protection Agency, Office of Water Regulations and Standards Report, September, 1980. 16 p, 57 Ref. WA-80-A055, 68-01-6058.

Descriptors: *Water quality control, *Water quality standards, *Phosphorus, Phosphates, *Estuaries, Aquatic life, Toxicity, Inorganic compounds, Federal jurisdiction, State jurisdiction, Legislation, Aquatic plants, Water pollution sources.

This digest is intended as a general information resource containing excerpts from the individual Federal-State water quality standards for phosphorus. The criteria are established to provide a threshold level which when exceeded would most likely result in aquatic life toxicity, due to elemental phosphorus, and excessive aquatic plant growth caused by phosphate phosphorus. The sources of phosphorus in water are given. The 1976 Quality Criteria for Water recommends a phosphorus criterion of 0.1 microgram per liter yellow (elemental) phosphorus for marine and estuarine waters. There is no freshwater criterion. Individual criteria are presented for the states, for the District of Columbia, and for overseas jurisdictions. (Brambley-SRC)
W81-02024

FEASIBILITY OF WATER QUALITY IMPROVEMENT IN THREE ILLINOIS RIVERS.
Arizona Univ., Tucson.
D. C. Wilkin, and R. C. Flemal.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 293-298, February, 1980. 10 Tab, 4 Ref.

Descriptors: *Water pollution sources, *Illinois, *Rivers, *Water quality, Nitrogen compounds, Phosphorus compounds, Heavy metals, Boron, Chlorides, Copper, Coliforms, Fluorides, Iron, Lead, Manganese, Mercury, Nitrates, Phenol, Sulfates, Zinc, Dissolved solids, Pollutants, Water quality control, Feasibility studies.

Point sources are not the major contributors of pollutant loading in 3 Illinois rivers, the Upper Sangamon and the West and East branches of the DuPage. Therefore, limiting emissions from point sources would not appreciably improve water quality in these rivers without non-point source control. In the Upper Sangamon undefined sources were responsible for 84 to 99% of the total loads of ammonium and nitrate nitrogen, boron, chloride, fluoride, methylene blue active substances, phenol, total phosphorus, sulfate, and a variety of metals. Fecal coliform accounted for in this way was 62%. In the other 2 rivers, fractions were more variable, with higher percentages of metals coming from undefined sources. (Cassar-FRC)
W81-02083

CHALLENGING COMBINED SEWER PROBLEMS IN JAPAN.
Ministry of Construction, Ibaraki (Japan). Water Quality Control Dept
For primary bibliographic entry see Field 4C.
W81-02103

R&D AT EPA: UPHILL RESPONSIBILITIES AND DOWNHILL FUNDING,
D. V. Feliciano.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 442-448, March, 1980. 2 Fig, 1 Tab.

Descriptors: *Government finance, *Research and development, Technology, Grants, *Water pollution control, Environmental Protection Agency, Anticipatory Research Program.

Research and development within EPA has always dealt primarily with practical studies to support regulation. EPA's Anticipatory Research Program has made it clear that basic research is a vital component of the research and development done by the agency. Now, in the Office of Research and Development, special individual research projects can receive funding under the Innovative Research Program. Also, there is a Science and Technology Achievement Awards program to stimulate basic research. Significant research accomplishments by selected EPA scientists and engineers were cited in 1980, and financial awards presented totaled $30,000. Funding and staffing remain tight for the Office of Research and Development due to funding trends and inflation. (Small-FRC)
W81-02113

GENERATION OF POLLUTING LOADS WITHIN RIVER BASINS,
National Inst. of Scientific Research, Quebec (Ontario).
For primary bibliographic entry see Field 5B.
W81-02134

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

A RESEARCH STRATEGY FOR ANTICIPATING CONTAMINANT THREATS TO AQUATIC RESOURCES,
Columbia National Fisheries Research Lab., MO.
For primary bibliographic entry see Field 5C.
W81-01906

REAL-TIME FORECASTING WITH A CONCEPTUAL HYDROLOGIC MODEL. I. ANALYSIS OF UNCERTAINTY,
Iowa Univ. Iowa City. Inst. of Hydraulic Research.
P. K. Kitanidis, and R. L. Bras.
Water Resources Research, Vol 16, No 6, p 1025-1033, December, 1980. 2 Fig, 1 Tab, 19 Ref.

Descriptors: *Statistical methods, Forecasting, *Hydrographs, Discharge measurement, Stochastic processes, *Streamflow forecasting, Probability, *Model studies, Mathematical models, Systems analysis, Methodology, Hydrography, *Real-time forecasting.

The National Weather Service catchment model is a large, nonlinear conceptual model in a mode amenable to analysis of uncertainty and the utilization of real-time information to update system states and improve streamflow predictions. It produces accurate short-term forecasts of river flows from rainfall information in 6 hour intervals and discharge observations . It is based on state space formulation in continuous form, linearization of nonlinear elements, and integration over discrete time periods. Linearization is performed with the uncommon multiple-input describing function technique for most strongly nonlinear responses and Taylor expansion for the rest. Error in the model stems from input uncertainty, parameter uncertainty, the initial state of the system, and model uncertainty. Correction for these errors is performed by updating systems states utilizing Bayes' theorem, stochastic descriptions of the output, and initial probability density functions. (Titus-FRC)
W81-01962

REAL-TIME FORECASTING WITH A CONCEPTUAL HYDROLOGIC MODEL. 2. APPLICATIONS AND RESULTS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
P. K. Kitanidis, and R. L. Bras.
Water Resources Research, Vol 16, No 6, p 1034-1044, December, 1980. 9 Fig, 9 Tab, 7 Ref.

Descriptors: *Statistical methods, *Streamflow forecasting, Probability, *Hydrologic models, Forecasting, Discharge measurement, Hydrographs, Mathematical models, Methodology, Hydrography, Systems analysis.

The application of a conceptual hydrologic model to a case study forecasting river discharges in the Cohocton River basin is discussed and evalated. Results indicate that the use of feedback significantly improves the overall forecasting capability of the model even when the model and input error statistics are not perfectly known. Comparison with a linear adaptive black box model strongly favors the conceptual model for longer forecast lead times. The present formulation of the conceptual model neglects timing errors which can appear in the rising limb of a hydrograph. Future research is needed to address uncertainty structure and the problem of compensating for errors in estimating the magnitude and timing of the hydrograph peak. (Titus-FRC)
W81-01963

A LOGICAL APPROACH TO THE DESIGN STORM CONCEPT,
Institute of Hydrology, Wallingford (England).
J. C. Packman, and C. H. R. Kidd.
Water Resources Research, Vol 16, No 6, p 994-1000, December, 1980. 9 Fig, 2 Tab, 12 Ref.

Descriptors: *Streamflow forecasting, *Design criteria, *Urban hydrology, *Design storms, Methodology, Storm drains, Mathematical models, Flood profiles, Simulation analysis, Sewers, Drainage systems, Pipes, Catchment basins, *Flood frequency, Design floods.

The application of sensitivity analysis to the determination of flood return periods and design inputs for peak runoff in given return periods is discussed. Current practice in storm drainage design is to adopt arbitrary storm parameters. Sensitivity analysis determines the antecedent conditions and design storm that consistently give flows which match an observed flood frequency distribution. Sensitivity analysis may be applied to various catchments to determine a stable set of inputs which can be applied generally for design purposes. Input may be generated by continuous simulation or by simulation in probability space, in the absence of sufficient field data. This methodology has been used in the Wallingford model, which was developed for application in the United Kingdom, and which has been calibrated. The methodology has application in designs for natural and urban catchments. (Titus-FRC)
W81-01971

STUDY OF LITTORAL CURRENTS IN COSTA DEL SOL IN RELATION TO THE PLACEMENT OF SUBMARINE OUTFALLS ENVISIONED IN THE COMPREHENSIVE TREATMENT PLAN. (ESTUDIO DE CORRIENTES LITORALES EN LA COSTA DEL SOL, EN RELACION CON LOS EMPLAZAMIENTOS DE EMISARIOS SUBMARINOS PREVISTOS EN EL PROYECTO DE SANEAMIENTO INTEGRAL),
Ministerio de Obras Publicas, Madrid (Spain). Aplicaciones Nucleares.
E. Baonza, and A. Plata.
Progress in Water Technology, Vol 12, No 1, p 345-367, 1980. 9 Fig, 1 Tab, 12 Ref.

Descriptors: *Baseline studies, *Ocean currents, *Diffusion, *Sewage, *Treatment facilites, Mathematical models, Waste water treatment, Municipal wastes, Water pollution sources, *Costa del Sol(Spain), *Mediterranean Sea, Planning, Construction, Sewage treatment plant, Data collections, Tracking techniques, Radioactive tracers.

A study was made of marine currents in the area of the proposed Costa del Sol sewage treatment plant using the radioactive tracer, bromine-82. The plant will remove suspended solids and floating solids and will affect two 100 km zones, one to the east and one to the west of Malaga. The waste water will be discharged into the sea, and the study was designed to find the most suitable discharge points. Over a period of two years, 146 tests were carried out. A mathematical model was developed and used to determine dilution at various distances from each discharge point tested. Known data were used to verify the model. (Small-FRC)
W81-01975

GROUNDWATER MODELS FOR WATER RESOURCES PLANNING,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02035

HYDROLOGY OF SELECTED BASINS IN THE WARRIOR COAL FIELD, ALABAMA--A PROGRESS REPORT,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
C. Puente, J. G. Newton, and T. J. Hill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-104754, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-22, March, 1980. 62 p, 18 Fig, 20 Tab, 23 Ref.

Descriptors: *Baseline studies, *Coal mining, *Hydrologic data, Surface waters, Groundwater resources, *Water quality, *Alabama, Mine drainage, Coal mine wastes, Hydrogeology, Data collections, Water analysis, Streamflow, Flow characteristics, Sediment yield, Water wells, Water yield, Water chemistry, Analytical techniques, *Warrior coal field(AL).

Hydrologic data are being collected in four basins in the Warrior coal field in Alabama to provide baseline information to aid in determining the effect mining will have on water resources. Basins monitored are in two different geologic and hydrologic environments. Two basins are underlain predominantly by relatively impermeable indurated rocks in the Pottsville Formation of Pennsylvanian age. The two remaining basins are underlain predominantly by unconsolidated permeable rocks in the Coker Formation of Late Cretaceous age. Well yields from the Pottsville Formation generally range from 0 to 0.3 liter per second, whereas well yields from the Coker Formation generally range form 0.3 to 6.4 liters per second. Streamflow distribution reflects seasonal precipitation. Storm runoff is characterized by sharply concentrated flows of short duration that rapidly recede to low-flow conditions. Streams draining basins underlain chiefly by the Pottsville Formation frequently go dry, whereas those draining basins underlain chiefly by the Coker Formation have well sustained low flows. Water in the Pottsville Formation is slightly acidic and moderately hard to very hard. Dissolved solids concentrations ranged from 176 to 268 milligrams per liter. Water in the Coker Formation is soft, far less mineralized, and more acidic than water in the Pottsville. Surface water is generally soft, acidic and low in dissolved solids concentrations. Water in streams draining basins underlain chiefly by the Pottsville Formation was slightly more mineralized and less acidic than water in streams draining the Coker Formation. (USGS)
W81-02038

BASELINE WATER QUALITY OF SCHMIDT, HORNBEAM, AND HORSESHOE LAKES, DAKOTA COUNTY, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
G. A. Payne.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-105645, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey, Water-Resources Investiga-

tions 80-3, 1980. 38 p, 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Baseline studies, *Road construction, *Water quality, *Lakes, *Minnesota, Eutrophication, Water analysis, Chemical properties, Physical properties, Biological properties, Limnology, Data collections, Sampling, Sites, Nutrients, Phytoplankton, Aquatic algae, *Dakota County(MN).

Three lakes in Dakota County, Minn., were sampled five times during an 18-month period to determine baseline water quality prior to construction of an interstate highway. Results of physical measurements and chemical analyses showed that the lakes were shallow, nonstratified, and nutrient enriched. Considerable seasonal variations in dissolved solids, nutrient, and dissolved-oxygen concentrations were observed. Oxygen depletion and high nutrient concentrations were characteristic of conditions under an ice cover in winter. Blue-green algal blooms typically were established soon after ice breakup and persisted until late fall. Data from the study will be supplemented with data collected during and after construction of the highway to assess the impact of highway construction and drainage on water quality of the lakes. (USGS)
W81-02039

DIGITAL MODEL OF THE BAYOU BARTHOLOMEW ALLUVIAL AQUIFER-STREAM SYSTEM, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
J. E. Reed, and M. E. Broom.
Geological Survey Open-File Report 79-685, 1979. 94 p, 10 Fig, 13 Tab, 8 Ref.

Descriptors: *Model studies, *Mathematical models, *Alluvial aquifers, *Arkansas, *Water resources development, Groundwater, Surface-groundwater relationships, Forecasting, Potentiometric level, Storage coefficient, Transmissivity, Withdrawal, Irrigation, Mississippi River, Arkansas River, *Bayou Bartholomew.

A digital model of the Bayou Bartholomew aquifer-stream system in Arkansas was calibrated for the purpose of predicting hydrologic responses to stresses of water development. The simulated-time span for model calibration was from 1953 to 1970, during which time the system was stressed largely by ground- and surface-water diversions for rice irrigation. The model was calibrated by comparing groundwater-level and streamflow data with model-derived groundwater levels and streamflow. In the calibrated model, the ratio of model-derived to observed streamflows for 17 subbasins averaged 1.1; the ratios among the subbasins ranged from 0.8 to 1.6. The average deviation of the differences between model-derived and observed groundwater levels at 47 nodes was 0.2; the average among the nodes ranged from -2.3 to 10.4. The average standard deviation of the differences between the model-derived and observed groundwater levels was 3.5; the average among the nodes ranged from 0.4 to 10.5. The model will provide projections of changes in the potentiometric surface resulting from (1) changes in the rate or distribution of groundwater pumpage or (2) changes in the stage of streams and reservoirs. The model will provide only approximate projections of the streamflow. (USGS)
W81-02044

COMPREHENSIVE BASIN-WIDE PLANNING OF SEWER SYSTEMS,
Ministry of Construction, Tokyo (Japan). Dept. of Sewerage and Sewage Purification.
Y. Kameda.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 884-889, May, 1980. 2 Fig, 1 Tab.

Descriptors: *Sewerage, *Comprehensive planning, *Legislation, Forecasting, Sewers, Water quality, Future planning(Projected), City planning, *Japan.

Comprehensive basin-wide planning of sewer systems in Japan is regulated by the 1970 version of the Sewerage Law. Prefectural governments are required to develop comprehensive sewerage programs which will help the area meet necessary water quality standards. Public waters requiring basin-wide planning are those that are polluted with discharges from two or more municipalities and for which water quality protection cannot be attained without the construction of a sewer system. The first step in planning is the determination of allowable load from the existing load at the source, the existing discharged load, and the ambient loads of the receiving body of water. Future pollution loads are estimated, and the required load reduction is determined. Naturally it is difficult to determine all of these parameters precisely, but strict precision is not necessary for basic planning. The required waste water treatment process level is then calculated. Urban areas with a population density of 40 persons/ha or more must be covered by such plans. Alternative waste water treatment options are always considered. (Small-FRC)
W81-02102

STOCHASTIC APPROACH TO WASTE TREATMENT PLANNING,
Utah Water Research Lab., Logan.
R. D. Hansen, A. B. Bishop, and R. Narayanan.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 275-287, March, 1980. 3 Fig, 5 Tab, 11 Ref.

Descriptors: *Stochastic processes, *Waste water treatment, *Planning, Model studies, Ashley Valley, *Utah, Mining, Population, Decision making, Mathematical models, Economics, Water resources development, Agriculture.

Planning public works, such as waste treatment plants, for areas facing uncertainty in economic events and population size is difficult. In the model described in this paper, a stochastic futures submodel, structured as a first-order Markov chain, is linked to a decision model. The model is applied to a study of Ashley Valley, Utah, an isolated rural area with uncertain growth prospects. Tables are developed listing 3 types of possible development (oil shale, a water resource and agricultural water project, and tar sands and phosphate mining) and 3 possible years (1980, 1985, 1990). This information, plus the costs of 4 sizes of waste water treatment units and damages caused by discharging untreated effluent, are used to determine the most cost-effective sizing and sequencing of waste treatment for the Ashley Valley area. (Cassar-FRC)
W81-02122

FAIRNESS CONSIDERATIONS AND ALTERNATIVE POLICIES,
Duke Univ., Durham, NC. Dept. of Civil Engineering.
J. J. Peirce, E. F. Joeres, and M. H. David.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 81-87, March, 1980. 9 Ref.

Descriptors: *Planning, *Alternative planning, *Fairness, *Decision making, Administration, Management, Methodology, Water pollution, Phosphorus compounds, Wisconsin.

This paper offers aid to water resource planners in generating fair alternative solutions to problems within the scheme of rational planning. Some fair solutions are based on the following definitions: contractural agreement (example, a group of industrial polluters jointly contract with a party to remove the undesirable material), precedent (any plan enacted in the past for a similar problem), market system (enables participants to interact in the open market and achieve a competitive price equilibrium), egalitarianism (all polluters are treated equally and must meet the same emission standards). Groups of equals are treated equally within the group, but unequal groups are treated according to need, worth, ability to pay, who receives benefits, and existing technology. Seventeen alternatives were developed to help solve the phosphorus problem in Wisconsin. Advantages of this method are (1) it allows for development of truly different alternatives, (2) it is efficient and flexible, (3) it complements existing problem-solving methods. (Cassar-FRC)
W81-02125

6B. Evaluation Process

COMBINED SEWER SYSTEM ANALYSIS USING STORM AND SWMM FOR THE CITY OF CORNWALL,
Gore and Storrie Ltd., Ottawa (Ontario).
For primary bibliographic entry see Field 5D.
W81-01922

ENERGY CRITERIA FOR WATER USE,
Florida Univ., Gainesville. Center for Wetlands.
F. C. Wang, H. T. Odum, and R. Costanza.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 185-203, March, 1980. 10 Fig, 3 Tab, 24 Ref.

Descriptors: *Water resources development, *Energy, *Mathematical models, Water management, Water utilization, Energy budget, Energy transfer, Flow, Model studies, Land use, Energy loss, Simulation analysis, Economics, Ecosystems.

The problems of land and water management have been addressed by a synthesis of theories from energy analysis, ecology and economics to arrive at optimum management techniques. It was assumed that water resources could be assessed in terms of their embodied energy content, which was calculated as the amount of energy required directly and indirectly to generate the flow in processes of the biosphere or a typical desalination plant. The flow produced by water use in an agricultural system or an urban economy was used to calculate the energy effect of water. The energy effect of water was compared with its embodied energy. An energy-quality value was utilized to put environmental and economic variables in a comparable unit. The general objective function of this unit was the maximum power principle, a self-organizing and optimizing criterion. A land use model representing the major land-use systems (agricultural, natural, industrial, and urban) was constructed and transformed into a standard linear programming problem. Parametric analysis was employed to obtain simulation results. The energy terms and concepts presented were recommended for use in organizing large ecosystems and in making decisions on water resource management in terms that may be easily compared with other questions on energy storage and supplies. (Geiger-FRC)
W81-02008

WATER AND POWER RESOURCES SERVICE PROJECT DATA.
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 8A.
W81-02011

ENERGY ANALYSIS FOR ENVIRONMENTAL IMPACT ASSESSMENT,
Florida Univ., Gainesville. Center for Wetlands.
F. C. Wang, H. T. Odum, and P. C. Kangas.
Journal of the Water Resources Planning and Management Divsion, Proceedings of the American Society of Civil Engineers, Vol 106, No WR2, p 451-466, July, 1980. 4 Fig, 6 Tab, 21 Ref.

Descriptors: *Decision making, *Environmental effects, *Power plants, Land use, *Energy, Planning, Natural resources, Flood plains, Mathematical studies, Economics.

Two powerplant sites are evaluated by energy analysis to determine minimum loss of economic potentials and depletion of natural resources. Many of the terms in the energy equations pertain to the energy inherent in various forms of water, e.g., rain, streams and floods. The examples illustrate the environmental impact of the powerplants on different types of land converted to powerplant and cooling pond use--agricultural land or forested flood plain. The optimum choice of plant location is the forested flood plain if it is based on the loss

to the economy of total environmental energy flows; and the agricultural land if the decision is based upon depletion of natural resources. (Cassar-FRC)
W81-02120

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

A COST-BENEFIT ANALYSIS OF WATER USE RESTRICTIONS,
Johns Hopkins Univ., Baltimore, MD.
For primary bibliographic entry see Field 3D.
W81-01952

CASE STUDY ON WATERLOGGING AND SALINITY PROBLEMS IN PAKISTAN,
National Engineering Services, Lahore (Pakistan).
For primary bibliographic entry see Field 3F.
W81-01953

DISTRIBUTION METHODS FOR TRANSFERABLE DISCHARGE PERMITS,
Illinois Univ. at Urbana-Champaign, Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W81-01960

COST-EFFICIENCY OF TRANSFERABLE DISCHARGE PERMITS FOR THE CONTROL OF BOD DISCHARGES,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
J. W. Eheart.
Water Resources Research, Vol 16, No 6, p 980-986, December, 1980. 3 Fig, 1 Tab, 12 Ref.

Descriptors: *Biological oxygen demand, *Permits, *Cost comparisons, Project planning, Water policy, Administrative agencies, Costs, Economics, Analysis, Cost-benefit ratio, Water quality.

The process of designing a system of transferable discharge permits is discussed and four proposed systems for biological oxygen demand control are compared to least-cost and minimum uniform treatment strategies for achieving the same water quality. Transferable discharge permit systems treat discharges as pollution rights which can be bartered and purchased. A system must include assurance of favorable environmental outcome, administrative simplicity, equity, and cost minimization. The four proposed policies each establish a dissolved oxygen impact coefficient and a definition basis for the permit. Mathematical models are generally required. All four versions of the transferable discharge permit were found to be cost efficient and below the minimum uniform treatment cost. Further research is needed to determine if the salient statistical properties of the systems are typical over a wide range of rivers and other water courses. Legal feasibility, procedures for enforcement, and detailed administrative structures must also be determined. (Titus-FRC)
W81-01967

FINANCING WASTE WATER TREATMENT IN JAPAN,
Ministry of Construction, Tokyo (Japan). Dept. of Sewerage and Sewage Purification.
K. Inaba.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 878-883, May, 1980. 1 Tab.

Descriptors: *Financing, *Government finance, *Treatment facilities, Bond issues, Cities, Waste water treatment, Construction costs, Operating costs, Maintenance costs, *Japan.

The past and present financing practices and the current financial structure of waste water treatment in Japan are described, and the prospects for the future are discussed. The Research Committee on Sewage Works Financing has recommended various financing schemes to meet the cost for construction of waste water treatment facilities and operating and maintenance costs. These involve some combination of government subsidies, assessments, and municipal funds. The present fiscal policy emphasizes public service. Every household in an area where sewerage is available is required by law to use it. Sixty percent of the total construction costs of public sewerage facilities are eligible for central government subsidy. This subsidy covers two-thirds of the construction costs of the plant and six-tenths of the construction costs of the sewers. Local government bonds cover 85% of the subsidized part. Ninety-three percent of total regional facility construction costs are eligible for government subsidy. Ninety percent of non-subsidized costs are covered by bond issue. (Small-FRC)
W81-02101

SEWER USER CHARGES IN OSAKA,
Japan Water Works Bureau, Osaka.
K. Takesada.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 985-991, May, 1980. 2 Fig, 5 Tab.

Descriptors: *Waste water treatment, *Sewerage, *Use rates, Prices, Osaka, *Japan, Maintenance costs, Operating costs, Cost sharing, Costs, Rates, Planning, *Water rates.

The city of Osaka has the highest population density in Japan, 2.7 million per 184.1 sq km area. Operation and maintenance costs for its sewer system, which serves 97.3% of the total city population, were 21 billion yen in fiscal 1979 (210 yen = 1 U. S. dollar), and capital costs including interest and depreciation, 22.3 billion yen. Sewer user charges began in 1920 and have been changed several times. The latest revision in 1972 changed the meter-rate system to the progressive-rate system in which a unit price per 1 cu meter increases with quantity of water used. A water quality surcharge, accounting for 4% of the sewer use revenues, is applied to substances that can be treated at treatment facilities, waste water of poorer quality than domestic waste water, and waste water approved by the city. Future plans include advanced treatment for water discharges into lakes and ponds, reuse of secondary effluent and sludge, and energy-saving measures. (Cassar-FRC)
W81-02109

6D. Water Demand

OUTDOOR RECREATIONAL USE AND PARTICIPATION INVENTORY OF THE LAKE MEAD NATIONAL RECREATION AREA,
Arizona State Univ., Tempe. Dept. of Leisure Studies.
G. W. Greey, G. W. Cheatham, and R. J. Virden.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-178378, Price codes: A18 in paper copy, A01 in microfiche. Technical report prepared for the Water and Power Resources Service, November, 1980. 412 p, 327 Tab, 2 Append. 14-06-300-2532.

Descriptors: *Recreation, *Reservoirs, *Use rates, *National Recreation Areas, Boating, Camping, Swimming, Sport fishing, Water utilization, Arizona, Nevada, *Lake Mead National Recreation Area.

For purposes of study and data collection, the Lake Mead National Recreation Area (LMNRA) was geographically divided into two separate regions: Lake Mead and Lake Mohave. The period of study was January 1, 1979 through December 31, 1979. Random sampling techniques were used to determine specific periods of data collection. During the study year, a total of 674,383 recreation units visited the Lake Mead Region, and 234,804 visited the Lake Mohave Region for a combined total of 909,187 units visiting the LMNRA during the study year. The projected number of visitors was 2,282,322 for the Lake Mead Region, and 775,861 for the Lake Mohave Region for a combined total of 3,058,182 during the same period. By rank order and frequency, visitors to the LMNRA participated in picnicking (2,919,272), swimming/related (1,898,913), boating (728,352), point of intermittent visit (702,460), camping (665,151), fishing (333,571), boat camping (138,659), houseboating (90,642), and a variety of other activities (143,039 combined). Lake Mead accounted for 54.8% of all water based participation while Lake Mohave accounted for 45.2% of all water based participation within the LMNRA during the study year. Combined water based participation totalled 881,953 or approximately 13% of all visitor participation. By rank order preference, Lake Mead visitors participated in swimming (228,950), fishing (101,283), and boat camping (60,617). Lake Mohave visitors participated in swimming (193,951) fishing (103,962), and boat camping (78,042) during the same period. (Moore-SRC)
W81-01937

STRATEGY FOR IRRIGATION DEVELOPMENT IN EGYPT UP TO THE YEAR 2000,
Ministry of Irrigation and Sudan Affairs, Cairo (Egypt).
For primary bibliographic entry see Field 3F.
W81-01950

THE ELEMENTS OF QUALITY AND SOCIAL COSTS IN RURAL WATER SUPPLY AND UTILIZATION,
Ibadan Univ. (Nigeria). Dept. of Geography.
F. O. Akintola, O. Areola, and A. Faniran.
Water Supply and Management, Vol 4, No 4, p 275-282, 1980. 1 Fig, 7 Tab, 5 Ref.

Descriptors: *Water resources development, *Rural areas, *Surveys, Wells, Water quality, Water utilization, Water demand, Water distribution, Agriculture, Social aspects, Water requirements, Ponds, Domestic water, Future planning, *Water costs, Water supply, Nigeria.

A survey was taken of village households in Ibarapa, Oyo State, Nigeria to determine water use patterns as background information for use in planning rural water supply improvements. The survey sought data on the size of each household, number of livestock, daily water requirements, sources of water during various seasons, water use from each source, and social and economic costs of rural water supplies. Oyo state lies between the Ogun and Oyan rivers, and only four settlements in the area have pipeline water supplies. The main occupation of the villagers is farming. Springs and ponds provided most of the people's water needs, which averaged a maximum of 26.1 liters/individual/day. Wells and dugout stream beds were more important as sources of water during the dry season. Definite preferences of water sources were shown for different household uses. On the average one hour was spent for each round trip to the water source during the wet season, while double that amount of time was needed to fetch water during the dry season. The most common waterborne disease among the villagers was guineaworm infection, which caused an average of 126 lost work days per year. Dysentery, rheumatism, cough and other ailments were also linked to water supplies and added to the number of work days missed. It was deduced that pipeline water supplies to rural areas would increase the number of manhours alloted to farm work by reducing the time spent fetching water and by reductions in work days lost due to water-borne diseases. Since the Savanna region of Ibarapa supplies most of Nigeria with food from its agriculture, the possible economic consequences of improved rural water supplies for the whole population of this nation should be considered. (Geiger-FRC)
W81-01954

A FIRST IN SOUTH AFRICA: THE STEENBRAS PUMPED STORAGE SCHEME.
For primary bibliographic entry see Field 8C.
W81-02051

RAND WATER BOARD,
Rand Water Board, Johannesburg (South Africa).
R. J. Laburn.
Imiesa (Johannesburg), Vol 4, No 5, p 48-49, 51, May, 1979. 3 Fig.

Descriptors: *South Africa, *Rand Water Board, *Vaal River, *Water supply, Reservoirs, Water distribution(Applied), Water supply development, Water treatment, Water management(Applied), Water purification, Water rates, Pumping, Utilities, Water delivery.

The Rand Water Board, organized in 1903, is a non-profit, autonomous public utility that supplies water in bulk to municipalities and other local authorities, to the mining industry, and to the South African Railways of the Witwatersrand area of South Africa. In 1923 the Board built the Barrage in the Vaal River in cooperation with the Department of Water Affairs. The Board is allowed to abstract, in perpetuity, 886, 470 cu m of water per day for no cost. The Board also abstrats additional water from the reservoir for a fee. The Board has two main water purification stations on the Vaal River. The stations use chemical coagulation, sedimentation, filtration, and disinfection. Continuous pumping is then used to move the purified water to the central Witwatersrand divide where it gravitates to northern, eastern and western regions. Local water authorities are responsible for boosting the water to their highest lying urban areas. The Rand Board's service reservoirs maintain a 36 hour supply with consumers being required to draw water at a near uniform rate. Consumer rates apply uniformly with no variations due to supply or location. The Board currently has two developments underway to ensure its continuing performance. (Seigler-IPA)
W81-02065

DURBAN'S WATER SUPPLY,
Durban City Engineer's Dept. (South Africa).
D. C. Macleod.
Imiesa (Johannesburg), Vol 4, No 5, p 37-41, May, 1979. 3 Fig, 1 Tab.

Descriptors: *South Africa, *Durban, *Water supply, *Water sources, Urbanization, Water resources, Gravity, Metering, Water demand, Population, Water storage, Silting, Diversion, Dams, Planning.

The Borough of Durban, South Africa has had various water sources since its declaration in 1854 including primitive wells, the Umbilo River, the Umhlatuzana River, the Umlaas River, and the Umgeni River. The area has been troubled by heavy siltation of its reservoirs and currently uses a three-dam system composed of the dams at Nagle, Nidmar, and Albert Falls. A universal metering program started in 1970 produced an overall reduction in demand and a period of recession has further reduced demand. Despite these reductions in demand, it is estimated that in the 1990's the assured yield of the Umgeni River will not meet the requirements of the area. One possible new water source would be the diversion of the upper waters of the Umkomaas River into the head waters of the Ungeni River. This is considered desirable as it would permit gravity supply to the Durban Metropolitan Area. Another possibility is drawing water from the Illovo River and diverting the lower reaches of the Unkomaas River. (Seigler-IPA)
W81-02067

6E. Water Law and Institutions

THE ELEMENTS OF QUALITY AND SOCIAL COSTS IN RURAL WATER SUPPLY AND UTILIZATION,
Ibadan Univ. (Nigeria). Dept. of Geography.
For primary bibliographic entry see Field 6D.
W81-01954

WATER IN THE ENVIRONMENT: THE UNEP EXPERIENCE,
United Nations Environment Programme, Nairobi (Kenya).
L. E. Obeng.
Water Supply and Management, Vol 4, No 3, p 155-170, 1980. 18 Ref.

Descriptors: *Reviews, *Water resources development, *United Nations, Water quality, Water supply, Water pollution, Water reuse, Governments, Hydrology, Rural areas, Cities, Organizations, Water management, Education, Social aspects.

The importance of water to all life forms, productivity, and the quality of life is reviewed, along with the activities of international agencies that seek to enhance the quality and services afforded by the earth's water resources. Many United Nations (UN) agencies are in existence which deal with the use of water at the domestic, industrial, and agricultural levels. Since the first UN Conference on the Human Environment, major world conferences have taken place that have emphasized topics related to water. The UN Environment Program (UNEP) Governing Council has been described as the central institution for environmental matters in the UN. Other agencies involved with water programs are the Center for Natural Resources, Energy and Transport, UNESCO's International Hydrological Program, FAO, WHO and about 25 other groups. Many of the programs of these agencies focus on some aspect of water quality or quantity. Other groups focus their activities on water pollution, irrigation, and data collections on general hydrology. The work of the agencies aids the UN in concentrating social efforts in developing countries in areas where they are most needed. Surveys conducted in 91 developing nations by the Governing Council have shown that 78% of 313 million people in rural areas and 23% of 450 million people in urban areas were without adequate water supplies. Improvements in water quality in third world nations have lessened the spread of water-borne diseases. The development of dams and irrigation systems in these nations has also helped to increase the acreage of farmable land and with it, food supplies. Certain UN agencies, especially UNICEF and UNEP, are involved in the education and training of individuals in the skills of water management. (Geiger-FRC)
W81-01955

DROUGHT MITIGATION STRATEGY: CONJUNCTIVE USE IN SMITH VALLEY, NEVADA,
Nevada Univ. System, Reno. Desert Research Inst.
A. S. Navoy, G. F. Cochran, and D. F. Schulke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173957, Price codes: A05 in paper copy, A01 in microfiche. Publication No 41069, 1980. 66 p, 18 Fig, 15 Tab, 41 Ref. OWRT-A-081-NEV(1), 14-34-0001-8030.

Descriptors: *Droughts, *Conjunctive use, *Hydrologic models, *Groundwater management, Water shortage, Water rights, Institutional constraints, Irrigation water, Legal aspects, Economic aspects, *Water law, *Nevada, Smith Valley(NV).

The surface irrigation water supplies of Smith Valley in Westcentral Nevada are susceptible to drought. The utilization of conjunctive groundwater for drought mitigation was estimated by converting electrical energy consumption of irrigation wells into total amount of water pumped. The amount of actual conjunctive groundwater pumped was separated from the total pumpage by contrasting pumping in the non-drought years of 1974 and 1975 to the drought years of 1976 and 1977. A lumped parameter systems model was developed for Smith Valley, based upon the characteristics and interrelationships of the water resources system. Various conjunctive pumping management schemes were modeled to investigate improving the drought mitigation capability. Due to the water cost framework, the management schemes simplify to increases in the allowable conjunctive pumpage. The model results indicated that a doubling of the present conjunctive groundwater rights would not manifest itself as a significantly greater groundwater storage deficit.
W81-01997

ORGANICS; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates Inc., Washington, DC.
For primary bibliographic entry see Field 5G.
W81-02016

INTERMITTENT STREAMS; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates Inc., Washington, DC.
For primary bibliographic entry see Field 5G.
W81-02017

GENERAL PROVISIONS/FREEDOMS; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates Inc., Washington, DC.
For primary bibliographic entry see Field 5G.
W81-02018

NITROGEN-AMMONIA/NITRATE/NITRITE; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates Inc., Washington, DC.
For primary bibliographic entry see Field 5G.
W81-02019

PESTICIDES; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates, Inc., Washington, DC.
For primary bibliographic entry see Field 5G.
W81-02020

TEMPERATURE; WATER QUALITY STANDARDS; CRITERIA DIGEST; A COMPILATION OF STATE/FEDERAL CRITERIA.
Environmental Protection Agency, Washington, DC. Office of Water Regulations and Standards.
For primary bibliographic entry see Field 5G.
W81-02021

ANTIDEGRADATION POLICIES; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates, Inc., Washington, DC.
For primary bibliographic entry see Field 5G.
W81-02022

OTHER ELEMENTS; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates Inc., Washington, DC.
For primary bibliographic entry see Field 5G.
W81-02023

PHOSPHORUS; WATER QUALITY STANDARDS; CRITERIA SUMMARIES; A COMPILATION OF STATE/FEDERAL CRITERIA.
Nalesnik Associates, Inc., Washington, DC
For primary bibliographic entry see Field 5G.
W81-02024

THE JAPAN SEWAGE WORKS AGENCY - ITS ROLE AND ACTIVITIES,
Japan Sewage Works Agency, Tokyo.
T. Kubo.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 873-877, May, 1980. 6 Tab.

Descriptors: *Treatment facilities, *Research and development, *Sewerage, Technology, Construction, Operation and maintenance, Institutions, Costs, Government, Legal aspects, *Japan.

The responsibilities of the Japan Sewage Works Agency (JSWA), established by the Japan Sewage Works Agency Act, include the construction, operation, and maintenance of public sewer systems. The agency aids local governments in improving sewer systems by training waste water engineers, offering technical assistance, and sponsoring research and development of water pollution control techniques. The costs of JSWA are borne equally by local and federal governments. JSWA has a

council which considers JSWA operating procedures and a board of directors which meets twice a year. JSWA has been primarily engaged in design and construction of waste water treatment plants under consignment agreements with local governments. Local governments make advance payments to the agency to cover agreed-upon costs. Upon completion of the project, JSWA conducts extensive tests, and once the project has been approved, further costs are split between the agency and local government. The Research and Technology Division conducts research, surveys, and tests for technological development. There is also a New Technology Evaluation Committee. (Small-FRC)
W81-02100

A SYNOPSIS OF PERSPECTIVES ON THE INNOVATIVE AND ALTERNATIVE TECHNOLOGY PROGRAM,
Maryland Univ., College Park. Dept. of Civil Engineering.
J. E. Alleman, and P. S. Price.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 460-464, March, 1980. 10 Ref.

Descriptors: *Federal Water Pollution Control Act, Technology, *Government finance, Recycling, Costs, Energy conservation, Grants, Research and development, Cities, Alternative technology, *Water reuse.

The Clean Water Act of 1977 includes a segment promoting the use of innovative and alternative (I/A) technology 'to force technology so that new and better alternatives which have not been demonstrated can become available'. The three primary objectives of such technology are: recycling and reuse of water and waste materials, energy conservation and recovery, and cost reduction. Incentives for I/A technology applications include an increase in the federal contribution for design and construction from 75 to 85%. If the system fails within two years, the municipality is guaranteed sufficient funds to repair or replace the unit. There has been some congressional displeasure with the constructions grant program, and changes may develop. The public has protested against the program because of excessive operations and maintenance costs, which have led to higher user costs. The program has not been successful in its attempts to move the engineering community towards alternative technology. (Small-FRC)
W81-02114

PROBLEMS IN APPLYING OPTIMAL IRRIGATION PLANS,
Idaho Univ., Kimberly. Dept. of Civil and Agricultural Engineering.
C. E. Brockway, and R. G. Allen.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 255-263, March, 1980. 2 Tab, 8 Ref.

Descriptors: *Irrigation systems, *Planning, *Teton Dam, *Optimization, Water rights, Water law, Open channels, Conveyance structures, Irrigation canals, Irrigation ditches, Canals, Water conveyance, Irrigation districts, Idaho, Dynamic programming, Linear programming, Salem Irrigation District, Efficiencies, Costs, Dam failure, Rehabilitation.

After the Teton Dam collapse in 1976 destroyed or damaged 65 irrigation districts in eastern Idaho, a limited time was available to plan for rehabilitation and updating irrigation systems. Inputs for the planning methods were cost coefficients and efficiencies for distribution and application system components. First, dynamic programming was used to build least-cost, efficient, distribution-system component configurations composed of lined and unlined channels and pipe sections using a branch and bound decision technique. Then linear programming was used to obtain least-cost system plans for the entire system. As an example, details for the 3,170 acre Salem Irrigation district are described. In this area, unlined channels with high seepage rates are used for subirrigation. Efficiencies, application, and energy costs are listed for 8 combinations of irrigation systems--sub-irrigation, unimproved furrow and border, improved furrow and border, and 3 types of sprinklers. Some of the constraints involved with planning this system were replacement with in-kind structures, farmer acceptance, jeopardization of water rights, increasing inflation, and energy costs. (Cassar-FRC)
W81-02123

6G. Ecologic Impact Of Water Development

IMPACT OF STREAM ALTERATIONS ON RIPARIAN COMMUNITIES IN SOUTHCENTRAL OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Ecology, Fisheries and Wildlife.
J. S. Barclay.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-166886, Price codes: A06 in paper copy, A01 in microfiche. Fish and Wildlife Service, Biological Services Program Report FWS/OBS-80/17, August, 1980. 105 p, 11 Fig, 35 Tab, 57 Ref. 14-16-0008-2039.

Descriptors: *Stream improvement, *Channeling, Land use, *Wildlife, *Vegetation, *Environmental effects, *Oklahoma, Wildlife habitats, Birds, Mammals, Amphibians, Reptiles, Impoundments, Riparian plants, Grasslands, Aquatic habitats, Erosion.

Concern over continuing losses of productive riparian wildlife habitat to extensive channelization and impoundment activities in the southern grasslands, plus a lack of regional information on alteration effects led to this study of stream alteration in Oklahoma. Two channelized streams, Rush and Wildhorse Creeks, and one impounded stream, Cobb Creek, were selected for study: they are all major tributaries of the Washita River within grassland ecoregions. Intensive plant and animal surveys were conducted on survey sites along 150 km of the streams. Channelization and land use changes along the two prairie streams resulted in or facilitated extensive loss and degradation of aquatic habitat; complete destruction of wetlands; nearly complete elimination of the bottom land forest; accelerated erosion; and reduced plant and animal species richness, diversity, and relative abundance. Land use was usually the most apparent factor determining vegetation differences between sites. Although the data on impoundment effects are conflicting from one life group to another, there appears to be a general tendency toward lower species diversity and higher relative abundance on the downstream sites, which may reflect the stabilized downstream flow. Exceptional care must be taken to minimize subsequent erosion and loss of adjacent riparian plant and animal communities when channelization is authorized for prairie streams. (Moore-SRC)
W81-02025

ENVIRONMENT AND WATER DEVELOPMENT IN THIRD WORLD,
Biswas and Associates, Ottawa (Ontario).
A. K. Biswas.
Journal of the Water Resources Planning and Management Divsion, Proceedings of the American Society of civil Engineers, Vol 106, No WR1, p 319-332, March, 1980. 2 Tab, 26 Ref.

Descriptors: *Planning, *Water resources development, *Resources development, Social aspects, Environmental aspects, Africa, Aswan Dam, Sedimentation, Public health, Agriculture, Irrigation systems, Diseases, Aquatic weeds, India, Third World.

This paper discusses the social and environmental effects of water development in the third world under three categories--physical, bilogical, and human effects. The positive and negative environmental effects of several water resource development projects are discussed--Egypt's Aswan Dam, India's Koyna Dam, irrigation systems and agriculture throughout the world. On a global scale 20 million square km of soil, or 35% of the currently used arable land, has been destroyed or degraded by poor management. Similarly, water development projects can affect the biological subsystem in beneficial or adverse ways. Although safe drinking water dramatically reduces the incidence of many water-borne diseases, irrigation projects in tropical regions can spread diseases such as schistosomiasis, liver fluke and malaria into new areas and promote growth of undesirable aquatic weeds in waterways. Potable water made easily available to a rural population can improve the life of the water-gatherers, 90% of whom are women. It is not unusual for a person to spend 5 hours every day hauling water. This wastes productive time, uses up dietary calories, and exposes the carriers to disease vectors. However, severe social problems may result when a large population is forced to move out of the path of a dam inundation. The planning processes must be sensitive to social and environmental guidelines, or the overall strategy may be self-defeating. (Cassar-FRC)
W81-02124

7. RESOURCES DATA

7A. Network Design

AN ORGANIC MONITORING SYSTEM FOR THE OHIO RIVER,
R. C. Kroner.
Public Works, Vol 111, No 5, p 81-84, May, 1980. 2 Fig, 4 Tab.

Descriptors: *Ohio River, *Monitoring, *Organic compounds, Water pollution sources, Carbon tetrachloride, Solvents, Water quality, Water quality control, Public health, Industrial wastes, Water pollution, Water analysis, Sampling, Gas chromatography, Rivers.

During the winter of 1976-1977, when increased levels of carbon tetrachloride were found in the Ohio River, it became apparent that an early detection and monitoring system for haloform organics was needed to protect the public from these pollutants. The Ohio River Valley Water Sanitation Commission (ORSANCO) in cooperation with the US EPA began using 8 semiautomated gas chromatographs along strategic points of the river to check the level of haloform organics during the first phase of an extensive monitoring plan. A raw water sample is subjected to purge-and-trap treatment in the daily analysis, and unknown organics may be identified by more extensive processes. In 1978 when the program first became operative, it was plagued by problems of untrained operators, equipment failures and lack of maintenance funds. However, the system was successful in detecting high levels of chloroform and carbon tetrachloride at the Kanawha River monitoring station, and the discharge problem was rectified after questioning the suspected discharging companies. In the second year of operation, specific discharge patterns of organics at each monitoring station were noted. Once a month duplicate samples are shipped to consulting laboratories, where they are analyzed by GC/MS as a quality control check. The addition of a second detector to handle purgeable non-halogenated compounds will greatly extend the monitoring capacity of the network. Other recommendations for more efficient river surveillance include increased sampling frequency and computerized data handling. (Geiger-FRC)
W81-01992

HYDROLOGIC NETWORKS: INFORMATION TRANSMISSION,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
W. F. Caselton, and T. Husain.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR2, p 503-520, July, 1980. 4 Fig, 3 Tab, 9 Ref.

Descriptors: *Hydrologic systems, *Network design, *Information exchange, Communication, Stations, Design, Data collection, Shannon information theory, Gaging stations, Sites, Synthetic

hydrology, Optimization, Vancouver, British Columbia.

A hydrological data collection network can be assessed by using information theory. The Shannon information theory is applied to this case (daily point precipitation) and is used to provide an optimization criterion for networks. An example is a 10-station 'temporary' network in the Vancouver, British Columbia, region, which experiences significant precipitation variations within the area. The method can compute the optimal number and sites for location of permanent stations. There are several advantages to using information transmission in network design. Stations of a network are assessed by their joint information conveying capabilities, not by summation of individual capabilities. Since there is no theoretical limit on the number of types of data, design of multipurpose networks is possible. (Cassar-FRC)
W81-02119

7B. Data Acquisition

ESTIMATION OF THE DOWNSTREAM RIVER WATER QUALITY WITH A POLLUTION LAND-USE DATA BANK,
Institut National de la Recherche Scientifique, Rimouski.
D. Couillard, and D. Cluis.
Water Supply and Management, Vol 4, No 4, p 263-268, 1980. 2 Fig, 3 Tab, 9 Ref.

Descriptors: *Monitoring, *Water quality, *Land use, Eutrophication, Nutrients, Nitrogen, Phosphorus, Model studies, Drainage area, Vegetation, Industrial wastes, Water pollution sources, Data storage and retrieval, Municipal wastes, River basins, Farm wastes, Data collections, *Quebec.

In order to alleviate expenditures associated with repetitive monitoring programs, a nutrient-oriented land use data bank based on information from the Mercator square-grid drainage system and from the Canadian Bureau of Statistics (vegetation coverage, land use, population, agriculture, industry) was developed. The bank served as a simple nutrient (nitrogen and phosphorus) transport model, which was tested on the Yamaska River basin, an intensive agricultural area of Quebec, to determine the relative importance of different pollution sources. Industrial pollution information was obtained from Scott's Industrial Directory, and a range of anticipated specific nutrient contributions was established based upon available data in the literature. Point-source polluters are associated directly to their outfall sub-basin unit, and non-point-source-polluters are distributed to the square-grid in proportion to the areas of the municipalities. The model showed good agreement with previous studies of nitrogen and phosphorus transport, and it was also useful in predicting the impact of treatment plants on nutrient loadings. (Geiger-FRC)
W81-01951

DIGITAL ON-LINE CLOSED-LOOP CONTROL FOR WASTE WATER TREATMENT OPERATION,
Metropolitan Denver Sewage Disposal District No. 1, CO.
For primary bibliographic entry see Field 5D.
W81-02090

SURFACE WATER INVENTORY THROUGH SATELLITE SENSING,
National Remote Sensing Agency, Hyderabad (India).
S. Thiruvengadachari, P. S. Rao, and K. R. Rao.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR2, p 493-502, July, 1980. 6 Fig, 1 Tab, 5 Ref.

Descriptors: *Remote sensing, *Surface waters, *Water resources, Impoundments, Water storage, Data collections, *Satellites(Artificial), Tamil Nadu, India, Lakes, Storage, Surveys, Hydrologic data, Measurement, Monitoring, Mapping, Areal.

Satellite sensing was used to monitor area and volume of 17 major reservoirs in Tamil Nadu State, India, to determine the feasibility of estimating water volumes in ungaged lakes used for domestic and irrigation water supplies. Information from Landsat, a sun-synchronous near-polar orbiting satellite, was used in regression analysis, which compared ground-based with satellite-derived waterspread area and satellite-derived area with ground-measured water volume. The correlation rate between waterspread areas obtained from satellite and ground observations was 96.6%. The satellite-derived waterspread area accounted for 83% of the variation in storage volume. Thus, storage volumes for an area of ungaged lakes can be estimated from a second regression equation. These estimates are more meaningful for a large area than for an individual lake. (Cassar-FRC)
W81-02115

7C. Evaluation, Processing and Publication

MAPS SHOWING GROUNDWATER CONDITIONS IN THE HASSAYAMPA AREA, MARICOPA AND YAVAPAI COUNTIES, ARIZONA--1978,
Geological Survey, Tucson, AZ. Water Resources Div.
H. W. Sanger, and C. L. Appel.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $5.25 in paper copy, $1.00 in microfiche. Geological Survey Open-File Report 80-584 (WRI), June, 1980. 2 Sheets, 7 Ref.

Descriptors: *Maps, *Groundwater, *Aquifer characteristics, *Water wells, *Arizona, Springs, Water levels, Water utilization, Irrigation, Water quality, Specific conductivity, Fluorides, *Hassayampa area(AZ), Maricopa County(AZ), Yavapai County(AZ).

The Hassayampa area includes about 1,300 square miles in west-central Arizona. The area consists of basins filled with alluvial deposits and mountains composed of crystalline and consolidated sedimentary rocks. The main water-bearing unit is the alluvial deposits, which consist of gravel, sand, silt, and clay. Other water-bearing units consist of crystalline and consolidated sedimentary rocks that may yield a few gallons per minute. In 1978 about 3,000 acre-feet of ground water was withdrawn from the area. Information shown on the maps includes depth to water, altitude of the water level, well depth, specific conductance, and fluoride concentration. Scale 1:125,000. (USGS)
W81-02028

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1979--VOLUME 1. NORTHEAST FLORIDA.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157513, Price codes: A24 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-79-1, November, 1980. 549 p, 33 Fig, 1 Tab, 13 Ref.

Descriptors: *Florida, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperatures, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Northeast Florida.

Water resources data for the 1979 water year in northeast Florida includes continuous or daily discharge for 52 streams, periodic discharge for 18 streams, peak discharge for 32 streams, continuous or daily stage for 14 streams, and periodic stage for 1 stream; continuous elevations for 23 lakes and periodic elevations for 28 lakes; continuous groundwater levels for 39 wells and periodic groundwater levels for 997 wells; and quality of water for 28 surface water sites and for 228 wells. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (USGS)
W81-02029

HYDROLOGIC DATA FOR OKALOOSA, WALTON, AND SOUTHEASTERN SANTA ROSA COUNTIES, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. R. Wagner, C. Lewis, L. R. Hayes, and D. E. Barr.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price code: $30.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-741, 1980. 228 p, 26 Fig, 20 Tab, 20 Ref.

Descriptors: *Hydrologic data, *Water quality, *Groundwater, *Surface waters, *Florida, Groundwater resources, Aquifers, Water wells, Test wells, Water level fluctuations, Pumping, Water yield, Rainfall, Hydrographs, Streamflow, Chemical analysis, Maps, Evaluation, *Okaloosa County(FL), *Walton County(FL), *Santa Rosa County(FL).

This report presents hydrologic and water-quality data collected within Okaloosa, Walton, and southeastern Santa Rosa Counties in northwest Florida. The data are presented in graphs and tables. Groundwater data include descriptions of wells and test holes, analyses of water quality, water level measurements, hydrographs of water levels and chloride concentrations in wells open to the upper part of the Floridan aquifer, and municipal and federal facilities pumpage. Surface-water data include streamflow measurements, streamflow hydrographs and analyses of water quality at selected stations. Maps of the area show locations of wells and surface-water stations. (USGS)
W81-02043

8. ENGINEERING WORKS

8A. Structures

THE ASPHALTIC CONCRETE LINING OF A RESERVOIR IN THE EASTERN TRANSVAAL,
Ove Arup and Partners (South Africa).
G. W. Plant, D. R. Priest, and A. R. Landby.
Civil Engineer South Africa, Vol 22, No 9, p 243-249, September, 1980. 9 Fig, 1 Tab, 10 Ref.

Descriptors: *Reservoir construction, *Reservoirs, *Reservoir leakage, Design criteria, Watertight, Prototypes, Materials engineering, Projects, Seepage, Water loss, Technology, Economics, Operation and maintenance, Resources development, Testing, Concrete mixes, *Asphaltic concrete, South Africa.

The design and construction of a raw water storage reservoir in South Africa is described. The reservoir is situated in the Eastern Transvaal and has a generating capacity of 3600 megawatts. The reservoir has two compartments with a total capacity of 885,000 cubic meters which provide storage equivalent to five days demand. This is the first reservoir in South Africa to use hydraulic asphalt concrete as the lining material. Advantages of this material are that with a multi-layer application weaker areas are covered by the use of staggered joints and irregularities can be leveled out. Disadvantages are that in some climates rapid cooling of thin layers occurs, and imperfect fusion may produce blisters and entrap moisture. The mix adopted for the South African reservoir was designed to meet the conflicting requirements of impermeability, flexibility and stability on the reservoir slopes. (Titus-FRC)
W81-01902

DEVELOPMENT OF AN URBAN HIGHWAY STORM DRAINAGE MODEL BASED ON SWMM,
Camp, Dresser and McKee Inc., Springfield, VA.
R. J. Dever, Jr., and L. A. Roesner.
Available from the National Technical Information

Service, Springfield, VA 22161 as PB81-173858, Price codes: A11 in paper copy, A01 in microfiche. In: Proceedings, Stormwater Management Model (SWMM) Users Group Meeting, 19-20 June, 1980, Toronto, Ontario, Environmental Protection Agency Report EPA 600/9-80-064, December, 1980, p 121-132. 2 Fig, 8 Ref.

Descriptors: *Urban drainage, *Highways, *Model studies, *Storm runoff, Urban runoff, *Storm drains, Drainage systems, Computer programs, Water quality, Precipitation(Atmospheric), Hydraulic design, Flow, Cost analysis.

The Urban Highway Storm Drainage Model consists of a powerful and flexible set of computer programs for highway drainage analysis and design. The capabilities of the model include statistical analysis of rainfall records, design of drainage systems including locating inlets and sizing pipes, analysis of drainage systems under extreme storm events, and simulation of runoff quality from the highway corridor. The model consists of four related but independent modules: Precipitation Module, Hydraulics/Quality Module, Analysis Module, and Cost Module. The Precipitation Module can perform a variety of statistical analyses on long-term hourly precipitation data and generate design storm hyetographs. The Hydraulics/Quality Module simulates time-varying runoff quantity and quality, locates stormwater inlets and sizes the conduits of the major drainage system. The Analysis Module simulates unsteady gradually-varied flow in the drainage system and can be used to analyze complex hydraulic conditions, such as surcharge and backwater, that may be encountered during an extreme storm event. The Cost Module can be used to estimate construction, operation and maintenance, and total annual costs associated with the drainage system. Two significant modifications to the Storm Water Management Model (SWMM) are the inclusion of the simulation of inlet hydraulics and the addition of kinematic cascades for overland flow. (Moore-SRC)
W81-01927

AIR-WATER FLOW IN HYDRAULIC STRUCTURES,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
H. T. Falvey.
Engineering Monograph 41, December, 1980. 155 p, 56 Fig, 74 Ref, 3 Append.

Descriptors: *Air demand, *Air entrainment, *Hydraulic structures, *Design criteria, Air-water interfaces, Hydraulic design, Open channel flow, Closed conduit flow, Free surfaces, Model studies, Computer programs, Jets, Pipelines, Intakes, Falling water surface.

The purpose of this report is to summarize the work that has been completed on air-entrainment and air-demand in both open channel and closed-conduit flows. The intent was to produce a concise reference source from which manuals, monographs, and charts for specific applications could be prepared. Methods have been developed to predict the mean air concentration and concentration distribution with open channel flow. A new description of the free water surface in high velocity flow is proposed which more accurately represents actual conditions in high velocity flow. The effect of air entrainment on the performance of a stilling basin can be estimated using a bulked flow concept. A computer program is presented with which the mean air concentration in steep chutes and spillways can be estimated. With exception of a falling-water surface and decreasing flow in pipelines, closed conduit flows require model studies. When properly conducted and analyzed, model studies will yield accurate data for estimating airflow rates. Experimental methods are discussed. A computer program is presented which can be used to predict the airflow rate with a falling-water surface. Design charts are presented for sizing air relief valves and vacuum valves on pipelines. The airflow rate in vertical shafts was found to be extremely dependent upon the flow conditions at the shaft inlet. Equations are included for estimating the airflow rate having various inlet conditions. Factors influencing the airflow rate around free falling jets are discussed. This area is identified as one needing additional research. Equations are presented from which the air entraining characteristics of a jet entering a pool can be estimated. (Moore-SRC)
W81-01936

ANALYSIS OF A CHANCE-CONSTRAINED RESERVOIR CONTROL MODEL,
IBM Watson Research Center, Yorktown Heights, NY.
For primary bibliographic entry see Field 4A.
W81-01959

SOIL CONDITIONS DICTATE DESIGN OF LAKE WEIR,
Oakland County Drain Commissioner's Office, Pontiac, MI.
G. Yrjanainen.
Public Works, Vol 112, No 1, p 59, January, 1981.

Descriptors: *Dams, *Weirs, *Soil types, *Whitehorse Lake(MI), Michigan, Engineering structures, Marl, Sand, Lakes.

A make-shift, deteriorating dam at Whitehorse Lake, Michigan, was replaced with a sheet pile structure after soil borings showed a stable sand base. The work was done in 10 working days at a cost of $23,850. Sixty square yards of gabion mattress was installed on the downstream side of the weir. The top was protected and smoothed by a welded steel channel. Stone rip-rap stabilized the shoreline. (Cassar-FRC)
W81-01994

WATER AND POWER RESOURCES SERVICE PROJECT DATA.
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
Water Resources Technical Publication, 1981. 1472 p, 8 Tab.

Descriptors: *Engineering structures, *Reservoirs, *Hydroelectric plants, *Conveyance structures, *Dams, Water control, Water distribution(Applied), Irrigation water, Storage, Recreation, Domestic water, Industrial water, Costs, Pumping plants, Canals, Construction, *Projects review.

Water and Power Resources Service projects, substantially complete and in operation, are reviewed in detail with considerable attention to history, costs, beneficiaries, engineering, and productivity. Newer projects in the early stages of construction, and projects which are authorized but not yet started, are treated briefly. Altogether, 135 projects are described. As of 1978, storage and distribution facilities had been constructed to serve 11.4 million acres of land with irrigation water. Crops harvested on farms receiving water from the Service in 1978 were valued at $4,993 million. Municipal and industrial water, 524,000 million gallons of it from Service projects, was delivered to areas populated by 16.6 million people. The 50 hydroelectric powerplants operating in 1978 had an installed capacity of 10.4 million kilowatts, and uprating units at existing facilities over 5 years will provide an additional 1 million kilowatt capacity. The hydroelectric energy totaling 40.6 billion kilowatt-hours generated in 1978 was sufficient to supply the residential needs of over 14 million people. There were 281 recreation areas, including reservoirs and other facilities on Service projects at the end of 1978. Recreational use of these areas increased during 1978 to a new record of 69.9 million visitor days. (Moore-SRC)
W81-02011

PIPELINE SOLVES FAR WEST RAND MINES WATER PROBLEM.
South African Mining and Engineering Journal, Vol 90, No 4150, p 96-97, May, 1979. 5 Fig.

Descriptors: *South Africa, *Pipelines, *Mine water, *Mine drainage, Flood protection, Hydraulic gradient, Corrosion control, Steel pipes, Welded joints, Steel structures, Subsurface drainage, Water transfer.

Gold Fields of South Africa has installed a 28 km pipeline at a cost of R4,500,000 to transport water from the Gemsbokfontein Compartment area to the West Driefontein canal in the Wonderfontein Valley. The pipeline is designed to accept and contain free flowing surface water and prevent it from entering into the mines beneath such as the West and East Driefontein. The pipeline will provide ground stability and safety as well as reducing the need for underground pumping. All portions of the pipeline are below the mean hydraulic gradient. The pipeline is composed of 9 m steel lengths alternately welded or connected by a loose sleeve coupling. Supports are located every 9 m. The project was completed in only four months and water flowed on December 5, 1977. The pipes are lined with Copon E 2300 for corrosion protection. Concor Construction was the major contractor. Since commissioning, flooding has caused some damage that has been repaired. (Seigler-IPA)
W81-02049

LESSONS FROM THE BAFOKENG DISASTER,
Department of Water Affairs, Pretoria (South Africa).
R. T. Rudd.
The Civil Engineer in South Africa, Vol 21, No 6, p 155-156, June, 1979.

Descriptors: *South Africa, *Bafokeng, *Slimes dams, *Mining engineering, *Dam failure, Dam designs, Dam foundations, Environmental effects, Pollution abatement, Design criteria, Water pollution, Overflow, Operation and maintenance, Erosion.

The failure of the slimes dam at Bafokeng has raised concern about the current methods of design, construction, operation and maintenance, and closure measures used for such structures. The Bafokeng dam was designed to provide a 'backstop' for pollution leaving the mine and to provide a water supply. It was located on a poor site with a long crest and was constructed of local materials such as rock, dunite, and slag from the sulfuric plant, rather than concrete. The failure of this dam shows that techniques suitable for one type of mining pollution control cannot simply be applied to all mining slimes dams. Topics of consideration for dam design and construction must include materials, mineral composition, pollution potential, geology, topography, climate, and hydro-meterology. Dam design should consider the importance of siting of a slimes dam and the impact to the environment in the event of failure. After construction, operation rules must be developed according to the design of the particular dam. Slimes dams must not be used to store water required for use or re-circulation. The failure of the Bafokeng dam appears to warrent a review of the current regulations regarding design freeboard and the associated design storms. (Seigler-IPA)
W81-02056

THE BAFOKENG DISASTER AND ITS LEGAL IMPLICATIONS,
Department of Water Affairs, Pretoria (South Africa).
R. T. Rudd.
The Civil Engineer in South Africa, Vol 21, No 6, p 146-150, June, 1979. 2 Tab, 2 Append.

Descriptors: *South Africa, *Bafokeng, *Slimes dams, *Legal aspects, *Dam failure, Dam designs, Environmental effects, Design criteria, Water pollution, Overflow, Operation and maintenance, Regulation, Mining engineering, Waste disposal.

Following the failure of the Bafokeng slimes dam in November 1974, mine authorities proposed remedial actions in compliance with South Africa's Water Act No. 54. Prior to the failure, the dam contained more than 13 million cu m of platinum slimes that were produced at the Bafokeng South Mine. All surface installations in the path of the slimes flow were destroyed and 12 men were killed when the slimes entered a shaft. Public streams

were polluted and a minor fish kill was reported at the Vaalkop Dam. Recommendations of short-, medium-, and long-term steps to assure the safety of the Vaalkop Dam waters included the construction of overspill rock barrier dams to prevent further runoff during the rainy season and settling basins to stop the spread of the slimes further down the valley. As a long-term action, the construction of safe, environmentally acceptable slimes and tailing dams should be reviewed. The Secretary of Water Affairs requested that all the facts relating to the Bafokeng disaster be released for the benefit of other mining authorities. Regulations pertaining to this disaster are reviewed including regional standards for industrial effluents in terms of chemical and physical parameters, waste water quality standards, safety aspects relating to materials poisonous to humans and animals, and management and design criteria concerning slimes dams that are regulated by the Water Act. (Seigler-IPA)
W81-02057

CAPE TOWN WATER AUGMENTATION SCHEME.
Municipal Engineer (Johannesburg), Vol 10, No 3, p 57-67, May/June, 1979. 16 Fig.

Descriptors: *South Africa, *Cape Town, *Water supply, *Water supply development, Dams, Pipelines, Aqueducts, Tunnels, Water conveyance, Pipes, Pumped storage, Concrete construction, Concrete pipes, Construction.

A 35 km aqueduct system is being constructed to deliver water from the Theewaterskloof and Assegaaibos Dams to pipelines in the Eerste and Berg River Valleys in South Africa. The system will give additional water supplies to the rapidly growing areas of Cape Town, Banta, and Mitchells Plain. The system, the Riviersonderend-Berg-Eerste River water scheme is expected to yield 83,000 MI/year. It is a joint effort by the City Council of Cape Town and the Government's Department of Water Affairs. Construction began in mid-1971 with the building of a 12 km aqueduct through the Franschhoek Mountains from the Theewaterskloof Dam to the Upper Berg River. Six other tunnels are being constructed with the entire system scheduled for completion in early 1981. With the construction of the aqueducts and dams, the final all-in cost of the project will amount to R110 million. An R23 million contract was awarded in 1976 to Southern Pipeline Contracts for the construction of the pipeline schemes. This system should provide adequate water supplies up to 1986 when additional supplies will probably be needed from the Palmiet River. (Seigler-IPA)
W81-02060

HYDROLOGICAL ASPECTS AND A BARRIER TO FURTHER ESCAPE OF SLIMES,
D. C. Midgley.
The Civil Engineer in South Africa, Vol 21, No 6, p 151-154, June, 1979. 5 Fig, 3 Tab, 5 Ref.

Descriptors: *South Africa, *Bafokeng, *Slimes dams, *Dam failure, *Hydrologic aspects, Design criteria, Mining, Water pollution, Rockfill dams, Design flood, Impoundments, Dam construction.

On November 11, 1974, the slimes dam at the Bafokeng Mine in South Africa failed following a rainfall of 75 mm in a 2 hour period. Evidence pieced together from eyewitness accounts and from photographs indicates that the dam was not overtopped. The most likely mechanism of failure was piping. To prevent further escape of slimes to the environment, a catchment dam was constructed in the local drainage to act as a settling basin. The catchment dam has a height of 6 m and, if empty, can arrest the total runoff from a single storm of 100-year return. The dam, with a crest length of 535 m, is the largest rockfilled dam in South Africa. The dam was completed in March of 1975 and, despite some repairs and additions, it has been quite successful. It is now used as a balancing reservoir for recirculated water and for water supply augmentation. Another plus is the abundant bird-life that has been attracted by the impoundment. (Seigler-IPA)
W81-02061

LINKSFIELD RESERVOIR: JOHANNESBURG.
Municipal Engineer (Johannesburg), Vol 10, No 3, p 15, 17-19, 21, May/June, 1979. 11 Fig.

Descriptors: *South Africa, *Linksfield Ridge, *Underground storage, Reservoirs, *Reservoir construction, Environmental effects, Archaeology, Vegetation regrowth, Revegetation, Vegetation establishment, Water storage, Vegetation effects, Planting management, Excavation, *Johannesburg.

Extensive preconstruction research was conducted to minimize the environmental effects of the new underground reservoir located in the Linksfield Ridge in the north-east sector of Johannesburg, South Africa. The reservoir will have a minimum capacity of 32 MI which will provide 24 hours of storage at peak summer demand in 1980. The reservoir site was investigated by an archeological team in 1977. Several sites were located including a prehistoric settlement of 12 stone structures, sites from the Iron Age, and sites from the Stone Age. These sites are being excavated and some of them will be reconstructed after the reservoir is completed. The reservoir will have a 5.5 m high cantilever wall with sloping floors for a maximum water depth of 8.69 m. A matrix analysis developed to minimize construction impacts recommended that the working area for the reservoir should be minimized, a cableway should be used for traffic movement, and the construction camp should be fragmented. After construction the reservoir will be covered with earth and revegetated. Spoil from the excavation will be used to build up a boggy area at Gilooly's Farm and to improve an area of Fotheringham Park. (Seigler-IPA)
W81-02064

MODELING RESERVOIR SYSTEM WITH PUMPED STORAGE,
Army Engineer District, Savannah, GA.
G. F. McMahon, V. R. Bonner, and B. S. Eichert.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 239-254, March, 1980. 3 Fig, 4 Tab, 13 Ref.

Descriptors: *Dams, *Simulation analysis, *Pumped storage, *Reservoir operation, *Savannah River, Georgia, Model studies, Reservoirs, Storage, Reservoir storage, Pump turbines, Recreation, Multiple-purpose projects, Operations, Power system operation, Hydroelectric plants, Water supply, Water storage, Water level fluctuations, Fluctuations.

A simulation study was performed on the Savannah River, Georgia, reservoir system, which includes 3 tandem dams--Hartwell, Russell (under construction), and Clark Hill. The purpose of the study was to determine the feasibility of installing pump turbines at Russell and predict the effects of pumped storage on recreational, environmental, hydropower, water supply and economic impacts of the 3 dams. Results yielded information useful for future operation of the system and for future water supply studies. Pumped storage would provide greater flexibility in meeting system requirements, and the ratio of primary energy shortage to system demand was 10% smaller than for system operation without pumped storage. System operation proved more efficient than operation for at-site requirements. This resulted in less pumping energy, reduced pool fluctuations, and a better balance of reservoir storage levels. (Cassar-FRC)
W81-02068

8B. Hydraulics

AIR-WATER FLOW IN HYDRAULIC STRUCTURES,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 8A.
W81-01936

SEDIMENT SUSPENSION IN TURBULENT PIPE FLOW,
Bechtel, Inc., San Francisco, CA.
S. T. Hsu, A. van der Beken, L. Landweber, and J. F. Kennedy.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY11, p 1783-1793, November, 1980. 3 Fig, 1 Tab, 11 Ref.

Descriptors: *Pipe flow, *Sediments, *Turbulent flow, Hydraulics, Suspended load, Pipes, Flow, Turbulence, Diffusion, Eddies, Velocity, Shear, Friction, Particle size.

A theoretical diffusion model for sediment suspension in turbulent pipe flow is described, and results of experiments to verify the analysis are presented. The model employs a coordinate system. Flow and suspension are treated as uniform along the pipe, and the model is limited to sediment concentrations that are small enough to preserve the axisymmetric distribution of flow properties such as shear stress, diffusivity, and streamwise velocity. For each experiment a fixed quantity of sand was placed in a pipe loop apparatus, and discharge was controlled while velocity profiles were measured across the vertical and horizontal diameters of the discharge. It was found that the velocity distributions were axisymmetric across a central core extending over 85 - 90% of any diameter. Comparisons with data from the literature suggest that the constant values of turbulent diffusivities for momentum and suspended sediment in pipe flow differ, but not widely. Excellent agreement was obtained between experimental results and the theoretical model. The model has the potential to be modified for large concentrations. (Titus-FRC)
W81-02077

GENERAL ALGORITHM FOR ROUGH CONDUIT RESISTANCE,
Wade, Trim and Associates, Taylor, MI.
S. Kumar, and J. A. Roberson.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY11, p 1745-1764, November, 1980. 14 Fig, 3 Tab, 23 Ref.

Descriptors: *Algorithms, *Hydraulic roughness, *Flow resistance, Hydraulics, Shear, Flow, Mathematical studies, Roughness coefficient, Channels, Physical properties, *Conduits, Pipes, Friction, Drag, Boundary processes.

A general algorithm for rough conduit resistance is presented, and relevant literature and field applications are discussed. The new contributions of the algorithm include development of a method for utilizing surface roughness profiles for resistance analysis, improved definition of fully rough conduits, and charts to determine flow resistance based on the geometry of the roughness elements. The algorithm addresses shear stress and velocity distribution for varying roughness conditions. Test measurements of resistance were made for iron pipes and natural streams. Test findings that the friction factor may become almost constant for both a fully rough and a semi-rough boundary under certain conditions were corroborated by the analytical results. Application of the algorithm to the strip type of roughness has not yielded satisfactory results. Some error is introduced to the algorithm because the size of the elements is not limited. In addition, the effect of local wake from upstream elements is not addressed, and conditions of very small roughness, in which a viscous sublayer could affect resistance, are not addressed. (Titus-FRC)
W81-02078

8C. Hydraulic Machinery

A FIRST IN SOUTH AFRICA: THE STEENBRAS PUMPED STORAGE SCHEME.
Imesa (Johannesburg), Vol 4, No 5, p 14-17, 19, 23, 25, May, 1979. 19 Fig.

Descriptors: *South Africa, *Pumped storage, *Steenbras reservoir scheme, *Hydroelectric

plants, *Reservoir storage, Electric power, Turbines, Penstocks, Intakes, Tunnels, Costs, Surge tanks, Economic prediction, Water supply, *Cape Town.

The upper reservoir of the Steenbras reservoir scheme will supply water for hydro-electric generation and will act as a reserve storage area for Cape Town, South Africa's water supply. The scheme has been developed jointly by the City Council and by Escom, the area's electric utility. The scheme is designed to minimize the City's overall cost of electricity by reducing its on-peak dependency on the utility. Water is pumped from the lower reservoir to the upper reservoir at night, an off-peak period with cheaper electric rates. This water is then released during on-peak periods to generate power. Extensive care was taken during the civil engineering to blend the works with the environment while maintaining economic optimization. The major components of the scheme include the upper reservoir, the upper intake works, the access adit, the low pressure tunnel, a surge shaft and tank, the high pressure shaft and tunnel, a steel penstock, the power station, and the lower control works and reservoir. Final project costs are estimated at R65 million or R360 per kilowatt. Within 10 years the cumulative discounted monetary savings are expected to be about R7 million. (Seigler-IPA)
W81-02051

8D. Soil Mechanics

RAISING STETTYNSKLOOF DAM.
The Civil Engineer in South Africa, Vol 21, No 9, p 223-227, September, 1979. 1 Fig.

Descriptors: *South Africa, *Stettynskloof Dam, *Dam construction, *Rock fill dams, Construction materials, Reservoirs, Water supply, Dam design, Damsites, Earthworks, Impoundments, Spillways, Water storage.

To raise its existing Stettynskloof concrete dam, the South African municipality of Worchester is constructing a composite earth and rockfill dam downstream of and abutting the concrete dam. The existing concrete dam was built in 1954 and holds 5 million cu m of water with its height of 30 m. The new composite dam will have a height of 48 m above the river bed level and will increase the reservoir capacity to 15 million cu m. This increase should be adequate to supply the area past the year 2000. Approximately half of the material for the new dam will be rockfill excavated from the riverbed downstream of the dam. Clay will be used for an impervious core zone. Earthfill materials will be taken from a borrow area in the reservoir basin. An R2.68 million contract was let in 1978 to Savage and Lovemoore Ltd with construction scheduled for completion in 1980. Construction equipment being used includes Caterpillar 769 dumptrucks, a Caterpillar 235 excavator, a Komatsu 085A bulldozer, and a 10 t Dynapac smooth drum and padfoot rollers. (Seigler-IPA)
W81-02062

8E. Rock Mechanics and Geology

VALIDITY OF CUBIC LAW FOR FLUID FLOW IN A DEFORMABLE ROCK FRACTURE,
California Univ., Berkeley.
For primary bibliographic entry see Field 2F.
W81-01969

THEORETICAL HEAD VARIOGRAMS FOR STEADY FLOW IN STATISTICALLY HOMOGENEOUS AQUIFERS,
Princeton Univ., NJ. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W81-01973

8I. Fisheries Engineering

STEENBRAS RESERVOIR: TROUT PLANTINGS AND RECOVERIES,
A. C. Harrison.
Piscator (Cape Town), Vol 32, No 104, p 111-115, Summer, 1979. 5 Tab, 1 Fig.

Descriptors: *South Africa, *Steenbras Reservoir, *Trout, *Fish stocking, Brook trout, Brown trout, Rainbow trout, Tiger trout, Smallmouth bass, Reservoirs, Fish establishment, Fish populations, Fry, Fish management, Fish reproduction.

Since its completion in 1920 the Steenbras Reservoir, which supplies water to Cape Town, South Africa, has been stocked with brown trout, tiger trout, rainbow trout, and brook trout. The Steenbras Reservoir has acid, peat-stained water which causes problems for trout. Although the trout introduced into the Reservoir have survived and grown, there has been no breeding. Smallmouth bass introduced in 1939 and 1940 have breed prolifically. Of the 76,040 brown trout stocked between 1952 and 1968, only 1,190 or 1.5% were caught and recorded. Scale-readings were used to determine age and to match a fish to its stocking group. Of 5,210 tiger trout, a hybrid brown trout and American Eastern brook trout, released from 1960 to 1967, only 197 or 4% were recovered. Between 1952 and 1954, 21,000 rainbow trout were released, but only 22 recoveries were recorded. Some rainbow trout were reported to have gone over the spillway of the dam. Since 1951, brook trout have also been stocked in the Reservoir, but they are difficult to identify. (Seigler-IPA)
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EFFECTS OF STREAM HABITAT IMPROVEMENTS ON INVERTEBRATES, TROUT POPULATIONS, AND MINK ACTIVITY,
Macdonald Coll., Ste. Anne de Bellevue (Quebec). Dept. of Renewable Resources.
S. A. Burgess, and J. R. Bider.
Journal of Wildlife Management, Vol 44, No 4, p 871-880, October, 1980. 2 Fig, 2 Tab, 23 Ref.

Descriptors: *Habitat improvement, *Stream improvement, *Invertebrates, *Environmental effects, Brook trout, Crayfish, Mink, Freshwater fish, Fish management, Aquatic habitats, Wildlife management, Wildlife habitats, Aquatic animals, Small animals(Mammals), Lac Carre, *Quebec.

A section of spring-fed mountain stream near Lac Carre, Quebec, was altered to provide improved habitat for brook trout. A similar 100 meter section of stream was left unimproved as a control. Changes included adding small dams of rocks and logs, large boulders, and cover. After 2 years the trout population and biomass in the improved stream increased by 208% and 179%, respectively; crayfish, by 220%. In the improved section, water temperatures were the same as in the control; insect populations were higher. Mink were 52.5% more active near the improved stream, but preyed mostly on crayfish and small mammals. Analysis of mink scats showed that trout were not an important prey. (Cassar-FRC)
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SELECTED WATER RESOURCES ABSTRACTS

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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 14, NUMBER 12
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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Office of Water Research and Technology. The cumlative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

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07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

GEOTHERMAL RESOURCES IN THE BANBURY HOT SPRINGS AREA, TWIN FALLS COUNTY, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
R. E. Lewis, and H. W. Young.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $5.75 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 80-563 (WRI), August, 1980. 35 p, 11 Fig, 5 Tab, 21 Ref.

Descriptors: *Geothermal studies, *Thermal springs, *Water temperature, *Water analysis, *Idaho, Water utilization, Water wells, Water level fluctuations, Water chemistry, Stable isotopes, Radioisotopes, Heat balance, *Banbury Hot Springs(ID).

Thermal water (30.0 to 72.0 degrees Celsius) is produced from 26 wells and 2 springs in the vicinity of Banbury Hot Springs near Buhl, Idaho. Thermal water is used for space heating of private residences, catfish and tropical fish production, greenhouse operation, swimming pools, and therapeutic baths. In 1979, 10,300 acre-feet of thermal water was utilized; heat discharged convectively from the geothermal system was about 1.09 x 10 to the 7th power calories per second. Decline in artesian head and discharge apparent in recorder charts from two wells may represent seasonal fluctuations or may reflect aquifer response to development of the resource. Thermal waters sampled are sodium bicarbonate in character and slightly alkaline. Mixing of a hot (72 degrees Celsius) water with local, cooler ground water can be shown from various relations between stable isotopes, chloride, and enthalpy. On the basis of concentration of trituim, age of the waters sampled is at least 100 years an perhaps more than 1,000 years. One water (33 degress Celsius) may be as young as 29 years. On the basis of silica, sodium-potassium-calcium, and sulfate-water geothermometers, best estimate of the maximum reservoir temperature for the thermal waters is between about 70 and 100 degrees Celsius. (USGS)
W81-02367

2. WATER CYCLE

2D. Evaporation and Transpiration

BARREN AREA EVAPOTRANSPIRATION ESTIMATES GENERATED FROM ENERGY BUDGET MEASUREMENTS IN THE GILA RIVER VALLEY OF ARIZONA,
Geological Survey, NSTL Station, MS. Water Resources Div.
O. E. Leppanen.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $4.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1003, 1980. 31 p, 6 Fig, 2 Tab.

Descriptors: *Evapotranspiration, *Heat balance, *Energy budget, *Arizona, Land Cleaning, Evaluation, Micrometeorology, Evaporation, Transpiration, Rainfall, Soil moisture, Bermudagrass, Phreatophytes, Gila River valley(AZ), *Gila River Phreatophyte Project.

Estimates of evapotranspiration for 479 successive days were created by using energy budget measurements. The measurement point was on the 2-kilometer wide flood plain of the Gila River in east-central Arizona, about 18 kilometers above Coolidge Dam. The flood plain had been cleared of all tall vegetation for distances of about 20 kilometers upstream and 5 kilometers downstream from the measurement site. Chaining, raking, and burning had been used to clear the area immediately surrounding the measurement site about 6 months before measurements began. Ground cover was sparse volunteer Bermudagrass and scattered seepwillow for a distance of at least 1 kilometer in all directions from the measurement point . The water table was deep, so most of the evaporated water came from rainfall, but some came from soil moisture deeper than 2 meters. The March to March water loss (evapotranspiration less rain) was about 47 millimeters, evapotranspiration demand was 377 millimeters. Daily rates varied from very small amounts of condensation to almost 5 millimeters of evapotranspiration. (USGS)
W81-02387

2E. Streamflow and Runoff

RUNOFF CALCULATION ON SEMI-ARID WATERSHEDS USING A ROTADISK RAINULATOR,
Arizona Water Resources Research Center, Tucson.
J. Morin, and C. B. Cluff.
Water Resources Research, Vol 16, No 6, p 1085-1093, December, 1980. 6 Fig, 4 Tab, 16 Ref. OWRT-B-015-ARIZ(4), 14-01-0001-1425.

Descriptors: *Runoff forecasting, *Rainfall-runoff relationships, *Arid lands, Infiltration, Watersheds(Basins), Mathematical models, Model studies, Forecasting, Hydrology, Atterbury watershed, Demonstration watersheds, Depth-area curves, Rainfall simulators, Semiarid climates, Southwest U.S., Rainfall, Soil surfaces, Soil moisture, Tucson, *Arizona.

Storm runoff depth from ungaged semi-arid watersheds was predicted by measuring infiltration rate with a rotating disk rainfall simulator and combining this information with data from recording raingages using a modified Horton-type equation. The method was tested on the Atterbury Experimental Watershed east of Tucson, Arizona. The good correlation between calculated and measured runoff values supports the thesis that surface crusting is the controlling factor in these watersheds. Standard deviation of the differences were 1-3 mm over a 3 year period. Maximum, average, and minimum infiltration curves were developed. Best correlation between measured and calculated values was obtained with the average curve. Maximum curves are useful in designing flood control projects, while minimum curves are valuable in planning water supply systems. (Cassar-FRC)
W81-02155

ESTIMATION OF SMALL-WATERSHED PEAK FLOWS IN CHINA,
Academia Sinica, Beijing (China). Inst. of Geography.
C. M. Liu, and G. Wang.
Water Resources Research, Vol 16, No 5, p 881-886, October, 1980. 1 Fig, 5 Tab, 6 Ref.

Descriptors: *Peak discharge, *Model studies, *China, Storm runoff, Watersheds(Basins), Flood peak, Runoff, *Streamflow forecasting, Channel flow, Flow, Overland flow, Surface runoff, Rainfall, Flood forecasting, Forecasting.

A model for predicting the flood peak discharge from storm rainfall in streams in small watersheds was developed from data measured on experimental watersheds and from physical geographical parameters such as soil type and terrain condition. Peak discharge in large basins is different from that in small basins. Differences in flow caused by physical factors (vegetation, soil type, slope, geology, location, drainage net, etc.) are much more pronounced in small basins, whereas in larger basins these effects tend to be averaged throughout the several tributaries. Comparison of estimated versus observed peak discharges in 16 locations in China showed average relative errors between 6.8 and 23.1%. The method has been successfully used to provide information for railroad and hydraulic engineering design in several regions of China. (Cassar-FRC)
W81-02208

COMPARATIVE STUDY OF PHYSICAL-CHEMICAL VARIABLES OF STREAMS USING MULTIVARIATE ANALYSES,
Battelle Pacific Northwest Labs., Richland, WA. Ecosystems Dept.
C. E. Cushing, C. D. McIntire, J. R. Sedell, K. W. Cummins, and G. W. Minshall.
Archiv fur Hydrobiologie, Vol 89, No 3, p 343-352, July, 1980. 2 Fig, 2 Tab, 12 Ref.

Descriptors: *Stream classification, *Running waters, Rivers, Base flow, Phosphorus compounds, Nitrates, Watersheds(Basins), Precipitation(Atmospheric), Channels, Variability, Solar radiation, Gradient(Streams).

Twenty-nine streams (34 sampling sites) in North America and Europe were categorized using 15 physical-chemical variables into 5 meaningful clusters, (ARID, ROCK, OREG, EAST, and WOOD) in an attempt to provide a classification scheme for streams similar to the oligotrophy-eutrophy systems for lakes. ARID sites have high solar radiation, low precipitation, high phosphorus content, large drainage basins, and low ratios of channel length to watershed area. ROCK sites share some of the above characteristics but have greater winter and summer base flows and precipitation, and lower phosphorus content. OREG are similar to ROCK but have greater precipitation and a larger ratio of channel length to watershed area. Solar radiation is somewhat less, and nitrates are low. EAST and WOOD share small watershed areas, low insolation, high terrestrial litter input, and intermediate precipitation. However, WOOD has higher winter and summer base flow and nitrate contents, and EAST has steeper gradients and larger ratios of channel length to watershed areas. Further evaluation of the physical-chemical variables is desirable, and a study of biological variables is essential. (Cassar-FRC)
W81-02253

FLOOD DEPTH-FREQUENCY RELATIONS FOR LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
A. S. Lowe.
Louisiana Department of Transportation and Development, Office of Public Works Water Resources Technical Report No 23, 1980. 14 p, 1 Plate, 1 Tab, 7 Ref.

Descriptors: *Flood forecasting, *Peak discharge, Water depth, *Regional analysis, *Louisiana, *Flood plains, Flood recurrence interval, Streamflow, Stream gages, Analytical techniques, Probability, Flood profiles, Hydrologic data.

Flood damage resulting from development of flood plains in Louisiana has caused considerable economical losses in recent years. Regional relations are defined for estimating the heights of floods having recurrence intervals of 25, 50, and 100 years for natural streams in Louisiana. Contributing drainage area is the only independent variable required for estimating flood heights for natural streams. The only limitations are that the streams be unregulated, that the contributing drainage area be in the range of values used to derive the relations, and that the equations be used on streams some distance upstream from their confluence. Data on flood heights for 191 gaging stations are given. (USGS)
W81-02349

LOW-FLOW CHARACTERISTICS OF STREAMS IN THE ST. CROIX RIVER BASIN, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
B. K. Holmstrom.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $10.75 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 80-696 (WRI), August, 1980. 62 p, 6 Fig, 3 Tab, 14 Ref.

Descriptors: *Low flow, *Streamflow, Low-flow frequency, *Streamflow forecasting, *Regression

analysis, Equations, Base flow, Evaluation, Flow characteristics, Flow duration, Flow rates, Wisconsin, *St. Croix River basin(WI).

Low-flow characteristics of streams in the St. Croix River basin, Wisconsin, are presented. Included are estimates of low-flow frequency and flow duration at 7 gaging stations, low-flow frequency characteristics at 23 low-flow partial-record stations and 78 miscellaneous sites, and a list of base-flow discharge measurements at 29 miscellaneous sites. Equations are provided to estimate low-flow characteristics at ungaged sites and at sites where one base-flow discharge measurement is available. The equations were determined from multiple-regression analyses that related low-flow characteristics at gaging stations and low-flow partial-record stations to basin characteristics. The standard error of estimate is provided for each method of estimating the annual minimum 7-day mean flow below which the flow will fall on the average of once in 2 years and once in 10 years. Standard error provides the user with the expected degree of accuracy for each method. (USGS)
W81-02368

LOW-FLOW CHARACTERISTICS OF STREAMS IN THE MENOMINEE-OCONTO-PESHTIGO RIVER BASIN, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
B. K. Holmstrom.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $11.50 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 80-749 (WRI), August, 1980. 82 p, 6 Fig, 2 Plates, 3 Tab, 18 Ref.

Descriptors: *Low flow, *Streamflow, Low-flow frequency, *Streamflow forecasting, *Regression analysis, Equations, Base flow, Evaluation flow characteristics, Flow duration, Flow rates, Wisconsin, *Menominee-Oconto-Peshtigo River basin(WI).

Low-flow characteristics of streams in the Menominee-Oconto-Peshtigo River basin, Wisconsin, are presented. Included are estimates of low-flow frequency at 12 gaging stations, flow duration at 10 gaging stations, and low-flow frequency characteristics at 23 low-flow partial-record stations and 137 miscellaneous sites. Equations are provided to estimate low-flow characteristics at ungaged sites and at sites where one base-flow discharge measurement is available. The equations were determined from multiple-regression analyses that related low-flow characteristics at gaging stations and low-flow partial-record stations to basin characteristics. The standard error of estimate is provided for each method of estimating the annual minimum 7-day mean flow below which the flow will fall on the average of once in 2 years and once in 10 years. The standard error of estimate for the 7-day 10-year low flow ranged from 6% to 76% depending on the type of data available. Standard error provides the user with the expected degree of accuracy for each method. (USGS)
W81-02369

FLOOD OF FEBRUARY 20, 1979, IN HILO, KAU, AND PUNA DISTRICTS, ISLAND OF HAWAII,
Geological Survey, Portland, OR. Water Resources Div.
D. D. Harris, and R. H. Nakahara.
Hawaii Division of Water and Land Development, Honolulu Circular C 81, March, 1980. 28 p, 14 Fig, 3 Tab, 6 Ref.

Descriptors: *Floods, Flash floods, Storms, *Storm runoff, *Hawaii, *Peak discharge, Flood damage, Flood stages, Flood discharge, Flood data, Hilo(HI), Kau(HI), Puna(HI).

The storm of February 18-20, 1979, produced extreme amounts of rainfall, which caused much flooding all along the lowlands of the eastern and southeastern coasts of the island of Hawaii. The most notable flooding occurred in the North and South Hilo Districts. Flooding throughout the Hilo District was the result of sheet runoff from the torrential rain. Throughout the city of Hilo, many homes and business establishments were flooded. In the Kau District, the greatest flooding occurred near Pahala. As in the Hilo area, much of the flooding resulted from sheet runoff. Because of the extreme road overflow, much of the Kau District was cut off from the rest of the island during the height of the flood. Flooding in the Puna District did not seem to be quite as severe as in the Hilo District, although numerous roads were closed for periods of time. On February 24, 1979, Governor Ariyoshi designated the Hilo, Kau, and Puna Districts as major disaster areas; on March 7, 1979, President Carter declared the island of Hawaii a major disaster area. (USGS)
W81-02376

DISCHARGE DATA AT WATER-QUALITY MONITORING STATIONS IN ARKANSAS, 1979 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
R. K. Knott.
Geological Survey Open-File Report 80-1213, 1980. 33 p, 2 Tab.

Descriptors: *Streamflow, *Flow rates, *Discharge(Water), *Water quality, *Arkansas, Basic data collections, Water pollution control

Discharge data were computed for a network of water-quality monitoring stations operated by the Arkansas Department of Pollution Control and Ecology. Some of the sites are located at U.S. Geological Survey or U.S. Army Corps of Engineers daily-discharge stations, but most sites are at points where discharges are not regularly measured. (USGS)
W81-02386

2F. Groundwater

IS TRANSPORT IN POROUS MEDIA ALWAYS DIFFUSIVE. A COUNTEREXAMPLE,
Ecole Nationale Superieure des Mines de Paris, Fontainbleau (France).
G. Matheron, and G. De Marsily
Water Resources Research, Vol 16, No 5, p 901-917, October, 1980. 9 Fig, 2 Tab, 21 Ref

Descriptors: *Solutes, *Groundwater movement, *Porous media, Fickian diffusion, Laplaces equation, Diffusion, Aquifers, Hydrologic properties, Diffusivity, Permeability.

Solute transport cannot generally be represented by the usual Fickian convection-diffusion equation in the special case of a stratified porous medium with flow parallel to the bedding. This is relevant for flow in certain types of fractured rocks where parallel fractures may allow the propagation of dissolved species without considerable lateral mixing if the general flow is parallel to the fractures. When the flow is not exactly parallel to the stratification, diffusive behavior is more likely to appear, but the time or length of displacement needed to obtain asymptotic behavior may be too large for application to real-life situations. Further work on the mechanism of transport in porous media is necessary. (Cassar-FRC)
W81-02209

CHEMICAL AND PHYSICAL CHARACTERISTICS OF NATURAL GROUNDWATERS IN MICHIGAN: A PRELIMINARY REPORT,
Geological Survey, Lansing, MI. Water Resources Div.
T. R. Cummings.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $4.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-953, August, 1980. 34 p, 12 Fig, 5 Tab, 13 Ref.

Descriptors: *Groundwater, Geochemistry, Water quality, *Water properties, *Michigan, Hydrogeology, Dissolved solids, *Chemical analysis, *Water analysis, Water types.

Wide variations occur in the chemical and physical characteristics of natural groundwaters in Michigan. Dissolved-solids concentrations range from 23 to 2,100 milligrams per liter. Waters having low dissolved-solids concentrations are calcium bicarbonate waters. Sodium, sulfate, and chloride increase as mineralization increases. Iron, aluminum, and titanium are higher at some locations than is common in most natural waters. Lead concentrations exceed those desirable in drinking water at some locations in the northern part of the Lower Peninsula. Generalized areal patterns of water quality variation suggest that geology is a primary cause of differences across the State. Examples of chemical associations in water suggest that chemical analyses may be valuable in tracing and identifying mineral deposits. (USGS)
W81-02345

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1979,
Geological Survey, Albuquerque, NM. Water Resources Div.
R. R. Cruz
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-753, May, 1980. 25 p, 11 Fig, 5 Tab, 3 Ref

Descriptors: *Groundwater resources, *Water wells, *Pumping, *Water yield, *Water quality, Water level fluctuations, Potentiometric level, Water analysis, Chemical analysis, Observation wells, Boreholes, Aquifer management, Hydrologic data, Military reservations, New Mexico, *White Sands Missile Range(NM)

Ground-water data were collected in 1979 at White Sands Missile Range in south-central New Mexico. Total ground-water pumpage from the Post Headquarters well field, which produces more than 98% of the water used at White Sands Missile Range, was 1.4 million gallons more in 1979 than in 1978. The most significant seasonal water-level declines observed in 1979 were in supply well 22 (36.35 feet) and test well T-7 (15.98 feet). The chemical quality of water samples collected in 1979 was similar to that collected at comparable depths and periods in 1978. (USGS)
W81-02353

APPROXIMATE LAND-SURFACE SUBSIDENCE IN THE HOUSTON-GALVESTON REGION, TEXAS, 1906-78, 1943-78, AND 1973-78,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02355

HYDROGEOLOGY OF THE TOWN OF NORTH HEMPSTEAD, NASSAU COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
C. Kilburn.
Nassau County Department of Public Works, Long Island Water Resources Bulletin 12, 1979. 87 p, 15 Fig, 36 Ref, 4 Plates

Descriptors: *Hydrogeology, *Aquifers, Aquifer systems, *Geologic formations, Aquifer characteristics, Aquicludes, Water levels, Well data, Hydrologic data, Maps, New York, *Long Island(NY), Town of North Hempstead(NY).

The groundwater reservoir underlying the Town of North Hempstead, Long Island, N.Y., is composed of unconsolidated glacial and interglacial deposits of Pleistocene age and terrestrial coastal-plain deposits of Late Cretaceous age that are underlain by bedrock of possible Cambrian-Ordovician age. The bedrock surface forms the base of the groundwater reservoir. The Cretaceous deposits consist of three hydrogeologic units, which are, from oldest to youngest, the Lloyd aquifer and Raritan clay, both of the Raritan Formation, and

the Magothy aquifer, which belongs to the Magothy Formation-Matawan Group, undifferentiated. In the northern parts of Great Neck and Manhasset Neck, the Cretaceous deposits are extensively eroded, and materials of Pleistocene age have been deposited adjacent to and upon them as well as upon the bedrock. The Cretaceous, Pleistocene and Holocene( ) deposits in these areas form two hydrogeologic units herein named the Port Washington aquifer and the Port Washington confining unit. Glacial deposits of late Pleistocene age and local deposits of Holocene age form the upper glacial aquifer. These undifferentiated deposits overlie the older deposits and abut them locally in buried valleys. The principal aquifers underlying the Town of North Hempstead are the Lloyd, Magothy, and Port Washington aquifers. (USGS)
W81-02357

PRINCIPAL AQUIFERS AND WELL YIELDS IN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02358

CAPE CODE AQUIFER, CAPE COD, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
B. J. Ryan.
Geological Survey Water-Resources Investigations 80-571, August, 1980. 23 p, 8 Fig, 5 Tab, 49 Ref, 3 Plates.

Descriptors: *Aquifers, *Groundwater, Aquifer characteristics, *Water quality, *Massachusetts, Water wells, Water table, Withdrawals, Pumping, Natural recharge, Municipal water, *Water pollution sources, Chemical analysis, Saline water-freshwater interfaces, *Cape Cod(MA), Cape Cod aquifer(MA).

Groundwater was the major source of drinking water on Cape Cod, Mass., in 1978. Withdrawals from over 100 municipal wells averaged 17.5 million gallons per day in 1978. Private wells on Cape Cod are estimated to number 15,000. Groundwater occurs primarily under unconfined or water-table conditions. Artesian conditions exist where fine silt and clay beds have been deposited along Cape Cod's north shore from Bourne to Brewster, locally along the south shore, and in parts of Chatham and Orleans. Natural recharge to the aquifer is entirely from precipitation. Discharge is by pumping; evapotranspiration; direct evaportion from the water table; and seepage to rivers, marshes, and the ocean. Groundwater quality is generally suitable for domestic uses, although some public and private water wells have been contaminated. Contaminants can enter the groundwater by infiltration from land surface, ponds, streams, and swamps. Infiltration from sewage lagoons, sand filter beds, septic tanks, cesspools, recharge pits, wells, or intrusion of saline water may also contaminate the aquifer. Alternative sources of drinking water, including desalination, transport from the mainland, and rainwater cisterns are many time more expensive. (USGS)
W81-02364

POTENTIOMETRIC SURFACE MAP OF WATER IN THE MADISON GROUP, MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02374

SUMMARY GROUNDWATER RESOURCES OF CENTRE COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02375

GROUNDWATER QUALITY IN NORTH IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
D. J. Parliman, H. R. Seitz, and M. L. Jones.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225. Price: $5.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-596 (WRI), July, 1980. 34 p, 8 Fig, 4 Tab, 20 Ref, 2 Plates.

Descriptors: *Water quality, *Groundwater, *Water chemistry, *Idaho, Baseline studies, Hydrogeology, Water treatment, Aquifers, Water wells, Sampling, Groundwater recharge, Water table, Groundwater movement, Water analysis, Chemical analysis, Dissolved solids, Nitrates, Iron, Trace elements, Hardness(Water).

From July 1977 to May 1978, water samples were collected from 116 wells north of the Palouse River in Idaho to define water-quality conditions, on a reconnaissance level, in major aquifers. Geologic and hydrologic data were combined with water-quality data to develop an understanding of factors affecting present and future groundwater quality. Samples were analyzed for 16 major chemical constituents, selected metallic trace elements, pH, specific conductance, water temperature, and total- and fecal-coliform bacteria. Locally, concentrations of dissolved solids, nitrite plus nitrate, iron, and cadmium exceeded mandatory or recommended limits established for public water supplies. Hardness exceeding 300 milligrams per liter may restrict groundwater use esthetically or economically. Groundwater quality is adequate and quantity is sufficient to meet population and economic demands as of 1978. (USGS)
W81-02377

GROUNDWATER AVAILABILITY AND SURFICIAL GEOLOGY OF THE ROYAL, UPPER PRESUMPSCOT, AND UPPER SACO RIVER BASINS, MAINE,
Geological Survey, Augusta, ME. Water Resources Div.
G. C. Prescott, Jr.
Geological Open-File Report 70-1287 (WRI), April, 1980. 4 Fig, 13 Ref, 3 Sheets.

Descriptors: *Groundwater availability, *Geology, Groundwater, *Groundwater resources, *Maine, Hydrogeology, Glacial drift, Aquifers, Aquifer characteristics, Water wells, Water yield, Water quality, Saco River basin(ME), Presumpscot River basin(ME), Royal River basin(ME).

The report describes the surficial geology and groundwater resources of parts of the Saco, Presumpscot, and Royal River basins, in Maine. Principal aquifers are the stratified glacial deposits of sand and gravel and the sandy alluvium of the Old Course Saco River north of Fryeburg. Under most favorable conditions, as much as 1,000 gal/min of water can be obtained from wells in the stratified glacial deposits. The bedrock yields water to many wells, but the median yield is only 5 gal/min. Water from unconsolidated deposits is generally of good chemical quality except in local areas where iron and manganese problems exist or the wells have been subject to contamination. Water from bedrock is more variable in character than water from unconsolidated deposits but is normally of good quality except where contaminated or where it contains iron and manganese concentrations in excess of U.S. Environmental Protection Agency standards. Water from granite and pegmatite bedrock has been reported to contain radon gas in excess of U.S. Environmental Protection Agency standards, but the epidemiological significance, if any, for the residents of southwestern Maine is not presently known. (USGS)
W81-02380

GROUNDWATER-LEVEL MONITORING FOR EARTHQUAKE PREDICTION--A PROGRESS REPORT BASED ON DATA COLLECTED IN SOUTHERN CALIFORNIA, 1976-79,
Geological Survey, Menlo Park, CA. Water Resources Div.
W. R. Moyle, Jr.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $10.00 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 80-413, June, 1980. 60 p, 23 Fig, 4 Tab, 9 Ref.

Descriptors: *Groundwater, *Water level fluctuations, *Forecasting, *Earthquakes, *California, Data collections, Water wells, Well data, Analytical techniques, Aquifer systems, Seismic studies, Atmospheric pressure, Water temperature, Water quality, Southern California uplift, Earth tides.

The U.S. Geological Survey is conducting a research program to determine if groundwater-level measurements can be used for earthquake prediction. Earlier studies suggest that water levels in wells may be responsive to small strains on the order of 10 to the minus 8th power to 10 to the minus 10th power (dimensionless). Water-level data being collected in the area of the southern California uplift show response to earthquakes and other natural and manmade effects. The data are presently (1979) being made ready for computer analysis. The completed analysis may indicate the presence of precursory earthquake information. (USGS)
W81-02382

WATER-RESOURCES DATA COLLECTED IN THE DEVILS HOLE AREA, NYE COUNTY, NEVADA, 1977-78,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-02391

SALINE WATER AT THE BASE OF THE GLACIAL-OUTWASH AQUIFER NEAR VINCENNES, KNOX COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
R. J. Shedlock.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118614, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-65, August, 1980. 54 p, 27 Fig, 7 Tab, 18 Ref.

Descriptors: *Saline water, *Groundwater, *Aquifers, *Water supply, *Indiana, Aquifer characteristics, Fractures(Geologic), Glacial drift, Groundwater movement, Saline water-intrusion, Surface-groundwater relationships, Model studies, Hydraulic conductivity, Sandstones, *Knox County(IN), Wabash River valley(IN).

A plume of saline water at the base of the glacial outwash aquifer near Vincennes, Indiana, has been drawn into the municipal well field. However, the average chloride concentration of the municipal water, 30 + or - 5 milligrams per liter, did not change significantly from 1976 to 1979. The plume, and elongated lens approximately 6,500 feet long by 1,500 feet wide, is 4 feet thick near the well field, and the chloride concentration of the water is 3,500 milligrams per liter. Half a mile to the west the thickness is 18 feet, and the chloride concentration is 5,100 milligrams per liter. The saline water seems to be entering the outwash aquifer through bedrock fractures near abandoned oil wells west of the well field. The fractures probably intersect unplugged intervals of the abandoned oil wells that convey saline water from bedrock aquifers at unknown depths. Digital model analysis indicates that doubling the 1978 pumping rate in the well field would cause water-levels declines of generally less than 8 feet. Solute-transport model analyses indicate that the chloride concentration of the well-field water would be less than 250 milligrams per liter for a saline-water intrusion rate ten times the model-calibrated rate. (USGS)
W81-02396

AQUIFER TESTS IN THE GALLUP SANDSTONE NEAR YAH-TA-HEY, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. S. McLean.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-103590,

Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-25, February, 1980. 25 p, 14 Fig, 1 Tab, 9 Ref.

Descriptors: *Aquifer testing, *Transmissivity, *Storage coefficient, *Hydraulic conductivity, *New Mexico, Aquifer characteristics, Well data, Model studies, Simulation analysis, Observation wells, Pumping, Drawdown, Leakage, *Gallup Sandstone(NM).

Aquifer tests of the Gallup Sandstone and associated units in the Yah-ta-hey well field in New Mexico have yielded values of transmissivity ranging from 250 to 400 feet squared per day and values of storage coefficient ranging from 0.00005 to 0.0001. A 2 1/2-month aquifer test was conducted in the spring of 1976 to provide data to better refine these values. The results of the long-term aquifer test were simulated in a digital model. A transmissivity of 300 feet squared per day, storage coefficient of 0.0001, and vertical hydraulic conductivity of the overlying Crevasse Canyon Formation of less than 0.0001 feet per day gave the best fit of simulated to observed drawdown in the pumped well and the two observation wells. (USGS)
W81-02397

GEOHYDROLOGY AND DIGITAL-SIMULATION MODEL OF THE FARRINGTON AQUIFER IN THE NORTHERN COASTAL PLAIN OF NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
G. M. Farlekas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-123002. Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-106, August, 1979. 55 p, 23 Fig, 1 Tab, 38 Ref.

Descriptors: *Model studies, *Aquifers, *Hydrogeology, *Coastal Plains, *New Jersey, Aquifer characteristics, Groundwater, Hydraulic conductivity, Water levels, Withdrawal, Inflow, Groundwater recharge, Aquitards, Northern Coastal Plain(NJ), Farrington aquifer.

A digital computer model was developed to simulate the Farrington aquifer in the Northern Coastal Plain of New Jersey. The aquifer, consisting mainly of the Farrington Sand Member of the Raritan Formation, is mostly sand with some gravel. The thickness of the aquifer ranges from a featheredge about 170 feet. Calibration of the model was achieved by comparing the observed potentiometric surface of November 1973 with the model computed potentiometric surface at the end of the 15-year simulation period. Hydrographs were also compared with model hydrographs. The calibration was made by matching the calculated head changes with observed head changes under a known stress during the 15-year period. Steady-state runs were made after the model was calibrated. Water levels determined by steady-state runs compared favorably with limited prepumping water-level data. Potentiometric surfaces for 1985 and 2000 computed on a projection of groundwater withdrawals for the period 1959-73 are similar to the November 1973 surface but are deeper. The cone of depression in the vicinity of Sayreville was projected by the model to be in excess of 100 feet below mean sea level by 1985 and exceeds 150 feet below mean sea level by 2000. Groundwater budget analyses for steady state and transient conditions for the entire study area and for several rectangular subareas yielded reasonable values of groundwater inflow and discharge. (USGS)
W81-02398

GROUNDWATER IN THE PIEDMONT UPLAND OF CENTRAL MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
C. A. Richardson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113813. Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-18, March, 1980. 42 p, 7 Fig, 7 Tab, 28 Ref.

Descriptors: *Groundwater, *Aquifers, *Groundwater availability, *Hydrogeology, *Maryland, Aquifer characteristics, Water sources, Water table, Water wells, Water yield, Water quality, Water utilization, Water supply, Maryland Piedmont.

Aquifers in a 130-square-mile area of the central Maryland and Piedmont, are shown to be the sole or principal source of water. The study area is underlain chiefly by crystalline rocks and partly by unaltered sandstones and siltstones. The groundwater is derived from local precipitation and generally occurs under water-table conditions. Its movement is restricted by the lack of interconnected openings, and most groundwater occurs within 300 feet of the land surface. Hydrographs indicate no long-term change in groundwater storage. A few wells yield more than 100 gallons per minute, but about 70% of 286 inventoried wells yield 10 gallons per minute or less; most specific capacities are less than 1.0 gallon per minute per foot. The groundwater quality is generally satisfactory without treatment and there are no known widespread pollution problems. Estimated daily figures on groundwater use are as follows; 780,000 gallons for domestic purposes; 55,000 for commercial purposes; and 160,000 for public supply. Although part of the area is served by an existing surface-water supply and could be served by possible extension of those and other public-supply water mains, much of the rural population is dependent on the groundwater available from private wells tapping the single aquifer that underlies any given location. Neither the groundwater conditions nor this dependence on individual wells is unique to the study area, but, rather, applies to the entire Piedmont province. (USGS)
W81-02400

2G. Water In Soils

ESTIMATING CRITICAL STRESS IN UNSATURATED SOILS FROM CHANGES IN PORE WATER PRESSURE DURING CONFINED COMPRESSION,
Science and Education Administration, St. Paul, MN.
W. E. Larson, and S. C. Gupta.
Soil Science Society of American Journal, Vol 44, No 6, p 1127-1132, November/December, 1980. 8 Fig, 1 Tab, 12 Ref

Descriptors: *Stress, *Soil physical properties, *Pore pressure, Soil compaction, Compressibility, Compacted soils, Pressure, Soil structure, Soil moisture, Mathematical studies.

When unsaturated agricultural soils are compressed by vehicular traffic, cultivation, or other mechanical stress, changes in structure and pore water pressure occur. This paper describes the changes in pore water pressure as a function of initial soil water content and applied stress. As unsaturated soils are compressed, pore water pressure decreases to a minimum and then increases. Curves obtained from plotting pore water pressure and log applied stress for a given soil with different water contents are similar in shape, but vary in scale. The degree of water saturation at which mimimum pore water pressure occurs is constant for a given soil. As clay content increases to 33%, the degree of saturation increases to 0.60 and remains constant. As applied stress increases beyond the point of minimum pore water pressure, soil aggregates are degraded. The maximum pressure a soil can withstand without damage to its aggregate structure corresponds with the point of minimum pore water pressure during compression. A procedure for estimating the critical stress for soils based on their clay content is developed. (Cassar-FRC)
W81-02210

SIMPLE METHOD FOR PREDICTING DRAINAGE FROM FIELD PLOTS,
Rockwell International, Richland, WA.
J. B. Sisson, A. H. Ferguson, and M. T. van Genuchten.
Soil Science Society of America Journal, Vol 44, No 6, p 1147-1152, November/December, 1980. 6 Fig, 4 Tab, 14 Ref.

Descriptors: *Drainage, *Hydraulic conductivity, *Infiltration, Subsurface waters, Conductivity, Groundwater movement, Seepage, Saline water intrusion, *Soil water movement, Forecasting, Numerical analysis, Equations.

The unit gradient method was used in the one-dimensional moisture flow equation to predict long-term drainage from soils. Three published hydraulic conductivity relationships (Watson, Davidson et al., and Brooks and Corey) were used to generate three analytical solutions for the drainage phase following infiltration. When log total water above a depth was plotted against log time, nearly straight lines were obtained. Two examples were given to show the accuracy of the method. The first compared the unit gradient method with a numerical solution of the complete flow equation. The second example applied the method to a field problem, drainage from a Gerber silty clay loam, typical of soils on which saline seeps occur. Both examples showed acceptable correlation. (Cassar-FRC)
W81-02211

PREDICTABILITY OF CHANGE IN SOIL REFLECTANCE ON WETTING,
Purdue Univ., IN. Water Resources Research Center, Lafayette, IN.
For primary bibliographic entry see Field 7B.
W81-02313

2H. Lakes

THE COMPOSITION AND ECOLOGY OF PERIPHYTON COMMUNITIES IN FRESHWATERS. I. THE INFLUENCE OF HOST TYPE AND EXTERNAL ENVIRONMENT ON COMMUNITY COMPOSITION,
University of East Anglia, Norwich (England) School of Environmental Sciences.
For primary bibliographic entry see Field 5C.
W81-02182

PHYTOPLANKTON FROM SWEDISH LAKES. III. LAKE HUNDSJON AND OTHER KETTLE LAKES OF CENTRAL SWEDEN,
National Swedish Environment Protection Board, Uppsala. Water Quality Lab.
T. Willen.
Archiv fur Hydrobiologie, Vol 89, No 1/2, p 135-159, June, 1980. 7 Fig, 1 Tab, 30 Ref.

Descriptors: *Lakes, *Phytoplankton, *Nutrients, Algae, Water quality, *Sweden, Eutrophication, Limnology, Aquatic plants, Aquatic algae, Conductivity, Lime, Acidic water.

Five small kettle lakes in Sweden were studied during 1964-1975. Lakes Hundsjon and Kattlammen, both with extremely low conductivity, high Secchi disc transparencies, low pH (4.9-6.5) and moderate nutrient concentrations, are located in a densely populated area. Plant life in Hundsjon included an abundance of moss, Drepanocladus polycarpus, on the bottom. Sometimes abundant desmids were present in the moss carpet. Macrophytes were sparse. Peridinium willei was dominant at times. Other frequently occurring algae were Botyrococcus, Dictyosphaerium, Oocystis, Staurodesmus, Stichococcus, and Chrysophyceans. Lake Kattlammen experienced a large development of Dinobryon spp., Dictyosphaerium elegans, Gloeotila curta and Peridinium inconspicuum before a lime treatment program was carried out in 1973-1974. Afterwards, these taxa were replaced by unstable and mixed populations of phytoplankton. The other three lakes were richer in nutrients, had higher conductivities, and had blooms of Anabaena, Gomphosphaeria, and Microcystis. All of the 5 lakes contained low numbers of diatoms. It is suggested that these lakes be preserved for study because of their unusual characteritics and their proximity to Stockholm and Uppsala. (Cassar-FRC)
W81-02184

GROWTH KINETICS OF FRESHWATER BACTERIAL POPULATIONS AND ISOLATED STRAINS,
National Research Inst. of Aquaculture, (Japan).
For primary bibliographic entry see Field 5C.
W81-02206

SIGNIFICANCE OF ALGAL EXTRACELLULAR PRODUCTS TO BACTERIA IN LAKES AND IN CULTURES,
Toronto Univ. (Ontario). Div. of Life Sciences.
C. Nalewajko, K. Lee, and P. Fay.
Microbial Ecology, Vol 6, No 3, p199-207, 1980. 4 Fig, 24 Ref.

Descriptors: *Bacteria, *Algae, *Lakes, Cultures, Lake Erie, Jack's Lake, Chlorella, Pseudomonads, Phytoplankton, Eutrophication, Diurnal, Glycolates, Limnology, Aquatic algae, Microbiology, Aquatic environment, Photosynthesis, Nutrients, Ecology, Symbiosis, Mesotrophic lakes, Eutrophic lakes, Ontario.

The relationship of bacterial growth to algal excreta (predominantly glycolate) was studied in the laboratory, in Jack's Lake (mesotrophic), and in Lake Erie (eutrophic). During a simulated diurnal laboratory experiment using Chlorella pyrenoidosa and Pseudomonas fluorescens, bacterial growth occurred in the daylight at the expense of glycolate. Mixed bacterial-algal cultures had lower glycolate levels and lower dissolved organic compounds than axenic Chlorella cultures. In both cultures glycolic acid and extracellular products decreased at night. When Lake Erie water was enriched with phytoplankton particles greater than 30 micrometers in size, 1,009 mg per cu meter algae were produced, compared with that in unenriched lakewater, 764 mg per cu meter algae. Total algal biomass was increased 32% by enrichment, but photosynthesis increased by only 17%. Daytime extracellular carbon release was 0.48 micrograms per hour in enriched water; 0.4 in natural water. In natural lake water bacterial counts increased equally, night and day. In the enriched systems numbers increased rapidly during the day and little during the dark. In enriched Jack's Lake water, photosynthesis was 32% higher and algal biomass 99.8% higher than in unenriched water. Daytime carbon excretion rates were 0.55 and 0.76 micrograms per liter in natural and enriched samples, respectively. thus bacterial growth can depend upon algal photosynthesis and extracellular release. (Cassar-FRC)
W81-02216

DIFFERENTIAL FILTRATION STUDIES OF CARBON FLUX FROM LIVING ALGAE TO MICROHETEROTROPHS, MICROPLANKTON SIZE DISTRIBUTION AND RESPIRATION IN LAKE KINNERET,
Kinneret Limnological Lab., Tiberias (Israel).
T. Berman, and C. Gerber.
Microbial Ecology, Vol 6, No 3, p 189-198, 1980. 4 Tab, 42 Ref.

Descriptors: *Bacteria, *Algae, *Organic matter, Respiration, Limnology, Aquatic microorganisms, Lake Kinneret, *Israel, Carbon radioisotopes, Photosynthesis, Filtration, Eutrophication.

The transfer of photosynthetically fixed, dissolved organic carbon from living algae to heterotrophic bacteria was not extensive, according to differential filtration studies (3 and 0.4 micrometers) conducted with surface water samples from the eutrophic Lake Kinneret, Israel. Samples were incubated with C14-bicarbonate for 3 hours in the light followed by 21 hours of darkness. Only 10% of the carbon fixed in the light was associated with particulate matter less than 3 micrometers in size. There was no significant decrease in the relative proportion of carbon taken up by larger (greater than 3 micrometers) organisms after the dark period. Respiration rates ranged from 3.4 to 21.2% of daylight net photosynthesis. Apparent residence time for glucose was 20-168 hours and, for amino acids, 20-152 hours. Most of the substrates for microbial heterotrophs were derived from detrital breakdown or animal excretions. (Cassar-FRC)
W81-02217

THE DOMINATING HIGHER ORDER VERTICAL MODES OF THE INTERNAL SEICHE IN A SMALL LAKE,
Michigan Univ., Ann Arbor, Div. of Biological Sciences.
B. D. LaZerte.
Limnology and Oceanography, Vol 25, No 5, p 846-854, September, 1980. 9 Fig, 1 Tab, 14 Ref.

Descriptors: *Lakes, *Seiches, *Resonance, Frequency, Surface waters, *Frain's Lake, Michigan, Limnology, Eutrophic lakes.

The internal seiche structure of Frain's Lake, Michigan, a small, shallow eutrophic lake (7 hectares in area and 3.5 meters mean depth) was dominated by the higher modes (up to 7th-10th). The relative amplitude of each mode varied with depth. The fundamental mode was transitory. Resonant frequencies and vertical velocity profiles of each mode predicted from observed temperature profiles corresponded closely with those observed. (Cassar-FRC)
W81-02218

IN SITU MEASUREMENT OF THE SETTLING VELOCITY OF ORGANIC CARBON PARTICLES AND 10 SPECIES OF PHYTOPLANKTON,
Canada Centre for Inland Waters, Burlington (Ontario).
N. M. Burns, and R. Rosa.
Limnology and Oceanography, Vol 25, No 5, p 855-864, September, 1980. 3 Fig, 3 Tab, 23 Ref.

Descriptors: *Phytoplankton, *Settling velocity, *Diurnal distribution, Organic carbon, Vertical migration, Eutrophication, Diatoms, Algae, Particle size, *Lake St. George, Ontario, Deposition(Sediments), Aquatic life, Zooplankton, Migration patterns.

Settling velocities of ten species of phytoplankton and three sizes of particulate organic carbon (POC) were measured in Lake St. George, a small eutrophic lake in Ontario. The three sizes of POC had similar fluxes. Settling velocities were 0.24 meters per day, 1-10 microns; 1.54 meters per day, 10-64 microns; and 2.32 meters per day, greater than 64 microns. There was little variation during the 24 hour period except for a slight increase in settling velocity and flux during the sunset period, perhaps due to fecal pellets from upward migration and increased grazing of zooplankton. Average settling velocities for the ten phytoplankton species varied from 0.08 + or - 0.11 to 0.32 + or - 0.32 meters per day. The species of phytoplankton varied in their response to light intensity. The flagellates migrated downward at sunset; a diatom species had a smaller settling velocity during daylight than at night; a blue-green alga showed maximum buoyance at midnight; and some green species moved downward on a bright day and upward on a dull day. Phytoplankton carbon fluxes were less than 1% of the total downward flux. (Cassar-FRC)
W81-02219

ROLE OF BENTHIC ALGAE IN TRANSPORT OF NITROGEN FROM SEDIMENT TO LAKE WATER IN A SHALLOW CLEARWATER LAKE,
Uppsala Univ. (Sweden). Inst. of Linmology.
M. Jansson.
Archiv fur Hydrobiologie, Vol 89, No 1/2, p 101-109, June, 1980. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Nitrogen compounds, *Sediment-water interfaces, *Lake sediments, Benthic flora, Ammonium compounds, Oligotrophy, Lakes, Limnology, Lake Stugsjon, *Sweden, Aquatic algae, Laboratory studies.

The oligotrophic Lake Stugsjon, Sweden, showed large increases in dissolved inorganic nitrogen during July and August each year. To test the hypothesis that the benthic algae assimilated inorganic N and released organic N by excretion and/or degradation, N15 labelled ammonium ion was added to sediment and N15 distribution followed. Three core samples were incubated for 3 days: one exposed to light, one in darkness, and one exposed to light and treated with HgCl2 to inhibit biological activity. In the light-exposed tube, a large amount of N15 was found in the benthic algae, little or none in the interstitial water. No unlabelled ammonium was detected. In the dark tube, N15 was rather uniformly distributed among the compartments analyzed, and the benthic algae incorporated only 20% as much N15 as did the algae in the light tube. Inorganic N15 appeared in the water above the core. In the biologically inhibited sediment and water, algae did not incorporate any N15 from ammonium. No dissolved organic N was found in the water. In all tubes, sediment adsorbed the major part of the added ammonium. These experimental findings were consistent with the theory that benthic algae removed ammonium from the interstitial water and prevented the flux of ammonium from the sediment to the lake water. (Cassar-FRC)
W81-02221

PHYTOPLANKTON RESPONSE TO SEWAGE REDUCTION IN VATTERN, A LARGE OLIGOTROPHIC LAKE IN CENTRAL SWEDEN,
Uppsala Univ. (Sweden). Inst. of Limnology.
For primary bibliographic entry see Field 5C.
W81-02222

EUTROPHICATION PARAMETERS AND TROPHIC STATE INDICES IN 30 SWEDISH WASTE-RECEIVING LAKES,
National Swedish Environment Protection Board, Uppsala. Algal Assay Lab.
For primary bibliographic entry see Field 5C.
W81-02223

A DILUTION MODEL APPLIED TO A SYSTEM OF SHALLOW EUTROPHIC LAKES AFTER DIVERSION OF SEWAGE EFFLUENTS,
Uppsala Univ. (Sweden). Inst. of Limnology.
For primary bibliographic entry see Field 5G.
W81-02231

SPECTRAL ABSORPTION PROPERTIES OF NATURAL WATERS: CONTRIBUTION OF THE SOLUBLE AND PARTICULATE FRACTIONS TO LIGHT ABSORPTION IN SOME INLAND WATERS OF SOUTH-EASTERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
J. T. O. Kirk.
Australian Journal of Marine and Freshwater Research, Vol 31, No 3, p 287-296, June, 1980. 1 Fig, 1 Tab, 15 Ref.

Descriptors: *Light penetration, *Absorption, *Phytoplankton, Tripton, Australia, Attenuation, Surface waters, Turbidity, Suspended solids, Gilvin, Color, Spectrometry.

Light in natural waters is absorbed by 4 components: the water, dissolved yellow coloring (gilvin), phytoplankton, and non-living particulate matter (tripton). This paper presents a method developed for measuring the absorption spectra and for calculating the in situ absorption coefficients of the plankton/tripton fraction, for which little data exists. Absorption coefficients have been used to calculate how much photosynthetically active radiation (PAR) is captured by the components. In clear, colored water, gilvin absorbs the most PAR, followed by water. In water containing a high level of phytoplankton, gilvin absorbs the most, followed by the particulate fraction and water. Tripton absorbs the most in highly turbid waters and is the most important light scatterer. (Cassar-FRC)
W81-02235

DIURNAL FLUCTUATIONS WITHIN A LITTORAL PLANKTON COMMUNITY IN OLIGOTROPHIC LAKE PAAJARVI, SOUTHERN FINLAND,

Helsinki Univ. (Finland). Lammi Biological Station.
T. Kairesalo.
Freshwater Biology, Vol 10, No 6, p 533-537, December, 1980. 1 Fig, 1 Tab, 19 Ref.

Descriptors: *Plankton, *Diurnal distribution, Phytoplankton, Littoral, Lake Paajarvi, Macrophytes, Zooplankton, Oligotrophy, *Lakes, Bosmina, Algae, Crustaceans, Aquatic plants, Aquatic life, *Finland, Aquatic environment, Limnology, Hydrogen ion concentration.

Species composition and abundance of zooplankton (predominantly microcrustaceans) and phytoplankton (algae, diatoms, and cryptophytes) varied diurnally in the area of a macrophyte stand in Lake Paajarvi, an ologotrophic brown-water lake. At night, in the shallow zones, algae decreased and microcrustaceans (Bosmina dominated) increased, possibly as a result of wind-induced water movement and zooplankton grazing. The Bosmina appeared to avoid water with high pH. Values for pH and oxygen saturation reflected the diurnal fluctuations. Diatoms and green algae dominated the littoral plankton in the innermost section of the macrophyte stand, cryptophytes in the outer areas. Eutrophic desmids were found in the innermost parts of the littoral area, where daytime pH could rise above 9. The upper limit for oligotrophic algae is 8.6-8.85. In the pelagial area, pH remained near 7. At the outer parts of the macrophyte stand water moved between littoral and pelagial zones, and algae populations were mixed. (Cassar-FRC)
W81-02240

ANAEROBIC METABOLISM OF PARTICULATE ORGANIC MATTER IN THE SEDIMENTS OF A HYPEREUTROPHIC LAKE,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
J. J. Molongoski, and M. J. Klug.
Freshwater Biology, Vol 10, No 6, p 507-518, December, 1980. 8 Fig, 1 Tab, 34 Ref.

Descriptors: *Eutrophication, *Anaerobic conditions, *Organic matter, Methane, Decomposing organic matter, *Lake sediments, Fermentation, Phytoplankton, Algae, Lakes, Sedimentation, Ammonia, Aquatic microorganisms, Hydrogen sulfide, Nitrates, Sulfates, Lake Wintergreen, Michigan, Surface waters, Hypolimnion, Shallow water, Seston.

The extent and mechanisms of anaerobic decomposition of particulate organic matter in the sediment of the shallow hypereutrophic lake, Wintergreen Lake, Michigan, were studied in 1976 and 1977. Most of the decomposition occurred through fermentation and methanogenesis, and was related to the rate of organic loading. During 1976 methane formation was inhibited after excessive organic deposition. Nitrate and sulfate were absent. Two to three weeks after large inputs of organic matter to the sediments, increased production of ammonia, hydrogen sulfide, volatile fatty acids, and methane were seen. Maximum concentrations of most metabolites were found at the sediment-water interface where initial degradation took place. Total methane production during the summer stratification was 34% of the particulate organic input in 1976 and 44% in 1977. (Cassar-FRC)
W81-02241

QUANTIFICATION AND CHARACTERIZATION OF SEDIMENTING PARTICULATE ORGANIC MATTER IN A SHALLOW HYPEREUTROPHIC LAKE,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
J. J. Molongoski, and M. J. Klug.
Freshwater Biology, Vol 10, No 6, p 497-506, December, 1980. 7 Fig, 1 Tab, 19 Ref.

Descriptors: *Eutrophication, *Phytoplankton, *Lakes, Algae, Sedimentation, Organic matter, Seston, Lake sediments, Suspended solids, Shallow water, Proteins, Hypolimnion, Photic zone, *Wintergreen Lake, Michigan, Surface waters, Limnology, Aquatic microorganisms.

Wintergreen Lake, Michigan, a shallow (maximum depth 6.5 meters) hypereutrophic lake, was studied from May to November in 1976 and 1977 to determine the quantity and quality of particulate organic matter reaching the sediments. In 1976 the sedimentation rate (in grams per sq meter per day) of the total seston was 2.7 to 19.3, while organic seston was 1.2 to 8.3. In 1977 these rates were 2.6-9.5 and 1.5-3.5 respectively. Sedimentation rates were lowest in spring, with peaks in October-November and variable rates during the summer. The amount of organic matter reaching the sediments was closely tied to the productivity of the phytoplankton, with sedimentation lagging about 1-3 weeks behind phytoplankton activity. The anaerobic hypolimnion was close to the photic zone. The sediment was high in organic content, particularly protein, but low in cellulose components. Many intact algal cells were identified, indicating that little decomposition of the algae took place during the short sedimentation distance. (Cassar-FRC)
W81-02242

STUDIES OF SALINITY STRATIFICATION IN SOUTHERN LAKE PONTCHARTRAIN NEAR THE INNER HARBOR NAVIGATION CANAL,
New Orleans Univ., LA. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2L.
W81-02311

VERTICAL MIGRATIONS OF ZOOPLANKTON IN THE ARCTIC: A TEST OF THE ENVIRONMENTAL CONTROLS,
New Hampshire Univ., Durham. Dept. of Zoology.
C. Buchanan, and J. F. Haney.
In: Evolution and Ecology of Zooplankton Communities, W. Charles Kerfoot, editor. University Press of New England, 1980, p 69-79. 8 Fig, 1 Tab, 41 Ref. OWRT-A-044-NH(3), 14-31-0001-5029.

Descriptors: *Vertical migration, *Zooplankton, *Diel migration, *Arctic, *Environmental controls, Migration, Environmental effects, Light intensity, Lakes, Ponds, Diel vertical migration.

Diel vertical migration studies of several zooplankton species were done in the arctic in experimental columns and in situ under a range of light cycles, including continuous sunlight. Populations did not migrate under continuous light in midsummer, but began to migrate when photoperiods shifted to <20h. The migrations occurred when the relative rate of change in light intensity was most rapid around sunset and sunrise. A diel cycle of unoriented swimming activity was observed under all light cycles in some of the species investigated. The 24-h-day depth of a population could be altered by temperature, food concentration, age, and diel cycles of activity. The association of zooplankton behavior with morphological and physiological features is discussed in terms of the selective forces for vertical migration.
W81-02312

MATHEMATICAL MODEL OF PHOSPHORUS RELEASE FROM LAKE SEDIMENT,
Japan Bottom Sediments Management Association, Tokyo.
For primary bibliographic entry see Field 5C.
W81-02323

LIMNOLOGICAL DATA FOR 12 RESERVOIRS IN VALLEY COUNTY, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
R. F. Ferreira.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $9.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-339, March, 1980. 68 p, 1 Fig, 5 Tab, 6 Ref.

Descriptors: *Limnology, *Reservoirs, *Water quality, *Water utilization, *Montana, Water properties, Dissolved solids, Nutrients, Trace elements, Sediment control, Multiple-purpose reservoirs, Northeastern Montana, *Valley County(MT).

Water samples were collected from 12 reservoirs in northeastern Montana during the late winter, spring, summer, and early fall of 1978. The resulting physical and chemical water-quality data will be useful in managing the reservoirs for use of stock watering, waterfowl propagation, fish production, and recreation. The surface areas of the reservoirs range for 0.4 to 28.1 hectares with water depths ranging from 0.25 to 6.9 meters. The chemical composition of water varied among reservoirs and with season. Specific conductance ranged from 446 to 4,020 micromhos per centimeter during the winter sampling period and from 62 to 999 micromhos per centimeter during the spring sampling period. Although a pH of 6.9 was measured at one reservoir during the winter, pH values generally ranged from 7.7 to 9.8. Under ice cover, which averaged 1.0 meter thick in late February, three reservoirs attained dissolved-oxygen concentrations above saturation. Each reservoir can be classified as having one of the following three water types: sodium bicarbonate, sodium sulfate, or calcium sodium bicarbonate. (USGS)
W81-02351

WATER BUDGET AND WATER-SURFACE FLUCTUATIONS, GREAT SALT LAKE, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
T. Arnow.
Geological Survey Open-File Report 78-912, 1978. 21 p, 9 Fig, 1 Tab, 7 Ref.

Descriptors: *Hydrologic budget, *Water level fluctuations, *Great Salt Lake, *Utah, Lake stages, Inflow, Discharge(Water), Consumptive use, Saline water.

The water-budget equation for Great Salt Lakes is: Inflow = Outflow + or - Storage change. The average annual inflow for the period 1931-76 was about 2.9 million acre-feet; 1.9 million acre-feet from surface sources, about 900,000 acre-feet from direct precipitation, and about 75,000 acre-feet from ground water. The average annual outflow for the same period, all be evaportion, also was about 2.9 million acre-feet. Storage changes are computed on the basis of changes in the surface level of the lake. During the period of historic record, 1847-1978, the lake surface has fluctuated within a range of about 20 feet but has shown little overall change. The lake surface would have been about 5 feet higher in 1978 than it was in 1947 had there been no consumptive use of water caused by man's activities in the lake basin. Since 1959 the lake has been divided into two parts by a railroad causeway, which has restricted the natural circulation. This has resulted in a difference of salinity and of surface level across the causeway. The difference in surface level between the two parts of the lake varies seasonally and annually and has been as much as 2.35 feet. (USGS)
W81-02361

WATER-QUALITY CHARACTERISTICS OF SELECTED LAKES AND RESERVOIRS IN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
L. J. Britton, and D. A. Wentz.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $18.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-436, (WRI), 1980. 139 p, 2 Fig, 1 Tab, 29 Ref.

Descriptors: *Water quality, *Lakes, *Reservoirs, *Limnology, *Colorado, Eutrophication, Water analysis, Data collections.

During the summers and autumns of 1973, 1974, and 1975, water-quality data were collected and compiled for 56 lakes and reservoirs in Colorado. The lakes and reservoirs sampled range from large reservoirs in the eastern part of the State to smaller natural lakes in the higher western parts of the Colorado Plateaus. The smallest body of water sampled was Anderson Reservoir No. 1 with a surface area of 47 acres in Mesa County, and the largest was Najajo Reservoir with a surface area of

15,600 acres in Archuleta County. The report includes physical, chemical, and biological water-quality data collected as a part of each lake or reservoir reconnaissance. Also included are data on drainage area, water-surface altitude, surface area,depth, storage capacity, and principal uses, obtained from various governmental agencies or the owner or regulating agency of each lake or reservoir. A subjective evaluation of the trophic (enrichment) state is presented based on nutrient and phytoplankton concentrations and the dissolved-oxygen distribution. In addition, a numerical trophic-state index, based on Secchi-disk transparency (a measure of light penetration) is reported, to show trophic comparisons between lakes and reservoirs. (USGS)
W81-02378

ESTIMATION OF BACKGROUND LOADINGS AND CONCENTRATIONS OF PHOSPHORUS FOR LAKES IN THE PUGET SOUND REGION, WASHINGTON,
Geological Survey, Seattle, WA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-02383

WATER QUALITY OF FOUR LAKES IN LAKEVILLE, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
L. H. Tornes, and M. R. Have.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119943, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-66, July, 1980. 51 p, 23 Fig, 4 Tab, 21 Ref.

Descriptors: *Lakes, *Water quality, *Limnology, *Minnesota, Eutrophication, Phytoplankton, Aquatic algae, Nutrients, Water analysis, Chemical properties, Physical properties, Biological properties, Bottom sampling, Dakota County(MN), Lakeville(MN).

Water-quality characteristics were determined for four lakes (Marion, Orchard, Kingsley, and Lee) in Lakeville, Minn., to provide background data and evaluate changes in lake water quality that may occur with urbanization. Thirteen samplings were done from March 1976 to October 1978. Physical characteristics of the lakes were defined and selected chemical and biological constituents were determined. Calcium carbonate precipitation is suggested by pH values as high as 10 near the surface and a decreases in the calcium concentration when magnesium, sodium, and chloride concentrations increase. Pollution of part of Marion Lake is indicated by chloride concentrations that increased from 18 to 57 milligrams per liter between June and October 1978. The eutrophic state of the lakes is suggested by supersaturated dissolved oxygen near the surface and dissolved-oxygen concentrations less than 0.1 milligram per liter near the deepest parts of the lakes in summer. Total phosphorus and chlorophyll a concentrations and Secchi-disk transparencies were used to determine the trophic state of the lakes. Trophic state indices were as high as 69.2. Phosphorus concentrations were significantly higher in Lee and Kingsley Lakes than in the other lakes sampled. Anacystis and Oscillatoria were the dominant phytoplankton genera. Phytoplankton blooms occurred throughout the year with the highest sampled concentration yielding 890,000 cells per milliliter during September 1976 in Lee Lake. (USGS)
W81-02399

2I. Water In Plants

DEPENDENCE OF DIOSCOREA TUBER GROWTH RATE ON WATER CONTENT OF AN ANDEPT SOIL,
New Jersey Agricultural Experiment Station, New Brunswick.
R. F. Dawson, J. E. Shrum, Jr., and R. A. Mohammed.
Soil Science Society of America Journal, Vol 44, No 6, p 1298-1302, November/December, 1980. 2 Fig, 2 Tab, 14 Ref.

Descriptors: *Plant growth, *Soil water, *Irrigation effects, *Water requirements, Crop production, Dioscorea, Planting management, Andept soil, Volcanic soil, Soil types, Aeolian soils, Crop response, Irrigation efficiency, Consumptive use, *Soil-water-plant relationships.

Dioscorea, a pharmaceutical crop from which is extracted a raw material used in cortisone manufacture, was grown on an experimental plantation in young volcanic soils in Central America. After several other crop management variables had been eliminated as factors in the poor crop production (less than 50% of projected), soil water content was studied. Stomatal activity as measured by leaf diffusion resistance increased with increase in soil water content. Thus, the highest rates of photosynthate deposited in the tubers resulted from the highest, but least efficient, rates of water consumption. The light, free-flowing Andept soils limited tuber growth rate by an inability to supply low-tension water uninterrupted. Tuber growth rate was 1.22 grams per week per gram of water (near maximum) at the highest water efficiency, 1.67 grams per liter. A proper soil for this crop represents a porous topsoil over a permanent water table or percolation barrier, suggesting that some fluvial andept soils be investigated. (Cassar-FRC)
W81-02214

2J. Erosion and Sedimentation

STOCHASTIC ESTIMATION OF BED LOAD YIELD IN POOL-AND-RIFFLE MOUNTAIN STREAMS,
Ministry of Works and Development, Christchurch (New Zealand). Water and Soil Div.
G. A. Griffiths.
Water Resources Research, Vol 16, No 5, p 931-937, October, 1980. 3 Fig, 3 Tab, 30 Ref.

Descriptors: *Stochastic processes, *Sediment transport, *Bed load, *Streams, Running waters, Sediment load, Hydrology, New Zealand, Model studies, Sediment yield, Mathematical models, Streambeds, Banks, Synthetic hydrology, Floods.

A stochastic model is developed to estimate bed load yield in pool-and-riffle mountain streams as additional information for design of flood control structures, debris retention dams, and bridges, as well as for studies of erosion rates and geomorphic processes. In mountain streams, water-borne sediment generally is derived from landslides, stream bank collapses, and other random mass movements. This characteristic produces different bed load yields from similar floods. Flood-produced sediment is stored in pools and moved gradually by lesser flows. Expected bed load yield in a given basin is predicted through the convolution of a Poisson number of events with an exponential probability of bed load yield. The exponential distribution is determined from flood frequency, an empirical bed load transport formula, and flow records from a similar, near-by basin. (Cassar-FRC)
W81-02207

A SEQUENCING SEDIMENT TRAP FOR TIME-SERIES STUDIES OF FRAGILE PARTICLES,
Woods Hole Oceanographic Institution, MA. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W81-02244

2K. Chemical Processes

EVALUATION OF SELECTED PROCESSES CONTROLLING NITROGEN LOSS IN A FLOODED SOIL,
Florida Univ., Sanford. Agricultural Research and Education Center.
K. R. Reddy, W. H. Patrick, Jr., and R. E. Phillips.
Soil Science Society of America Journal, Vol 44, No 6, p 1241-1246, November/December, 1980. 5 Fig, 7 Tab, 33 Ref.

Descriptors: *Saturated soils, *Nitrogen compounds, *Diffusion, Nitrates, Ammonium compounds, Nutrient removal, Nitrogen cycle, Denitrification, Nitrification, Ammonification, Gases, Chemical reactions, Soil water, Aerobic conditions, Anaerobic conditions, Oxidation, Reduction(Chemical), *Nitrogen loss control.

Nitrogen loss from continuously flooded soils was studied in fine silty soils. Major processes controlling nitrogen loss, which function simultaneously and continuously in flooded soils and lake bottoms, are ammonium-nitrogen diffusion, ammonium-nitrogen oxidation, nitrate-nitrogen diffusion, and nitrate-nitrogen reduction. The respective rates of these processes were 0.059 to 0.216 sq cm per day, 1.2 to 3.5 micrograms per gram per day, 0.96 to 1.94 sq cm per day, and 0.315 to 0.520 micrograms per gram per day, with half lives ranging from 1.3 to 2.2 days. Calculations to compensate for the differences in units indicated that the slow rates of ammonium diffusion from the anaerobic soil layer to the aerobic soil layer and the ammonium oxidation in the aerobic soil layer are limiting factors in controlling nitrogen loss. Conversely, the more rapid nitrate diffusion into the anaerobic soil layer and nitrate reduction in the anaerobic soil layer are not limiting factors in nitrogen loss. (Cassar-FRC)
W81-02212

CHEMICAL ANALYSES FOR SELECTED WELLS IN SAN JOAQUIN COUNTY AND PART OF CONTRA COSTA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02343

CHEMICAL AND PHYSICAL CHARACTERISTICS OF NATURAL GROUNDWATERS IN MICHIGAN: A PRELIMINARY REPORT,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02345

SIMULATION OF WATER-QUALITY DATA AT SELECTED STREAM SITES IN THE MISSOURI RIVER BASIN, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02346

2L. Estuaries

GRANULOMETRIC DEPENDENCE OF CHROMIUM ACCUMULATION IN ESTUARINE SEDIMENTS IN MAINE,
Maine Univ. at Orono, Walpole. Dept. of Oceanography.
L. M. Mayer, and L. K. Fink, Jr.
Estuarine and Coastal Marine Science, Vol 11, No 5, p 491-503, November, 1980. 10 Fig, 1 Tab, 30 Ref. OWRT-B-016-ME(3).

Descriptors: *Sediments, *Chromium, *Estuaries, Nutrients, Water pollution sources, Minerals, *Maine, Granules, Particle size, Fluctuations, Trace elements, Intertidal areas.

The distributions of chromium pollutants in four estuaries in Maine were examined by studying variations of chromium concentrations with grain size in estuarine sediments. An indicator of sediment texture was devised, based on the sediment specific surface area, which has been shown to be superior to measurements of the proportion of fine-grained sediment for detecting regional fluctuations in chromium concentration with sediment texture. The main control on chromium levels in the four systems studied was mineralogy. A textural normalization technique was applied, which employed specific surface areas in estuaries receiving a chromium-rich effluent to differentiate pure from polluted sediments. Effluent chromium accumulates within the estuary rather than in adjacent coastal

sediments, with chromium concentration occurring in intertidal zones instead of subtidal areas. (Geiger-FRC)
W81-02157

ECOLOGICAL STUDIES OF THE KELP, LAMINARIA HYPERBOREA, AND ITS ASSOCIATED FAUNA IN SOUTHWEST IRELAND,
Cambridge Univ. (England). Zoological Lab.
A. Edwards.
Ophelia, Vol 19, No 1, p 47-60, May, 1980. 6 Fig, 3 Tab, 36 Ref.

Descriptors: *Bioindicators, *Kelps, *Turbidity, Aquatic life, Estuaries, Sediments, Pollutant identification, Bantry Bay, *Ireland, Suspension, Speciation, Aquatic animals, Laminaria hyperborea.

It has been suggested that the performance of a holdfast kelp, Laminaria hyperborea, and the suspension-feeding fauna associated with it were an indication of water pollution. This study shows that natural increases in turbidity may also affect this system. The fauna associated with the kelp in bays and rivers in southwest Ireland were counted and classified. Water at Eagle Point and the Boar in Bantry Bay was very turbid, but pollution sources were minimal. Nevertheless, the fauna had low species diversity and were dominated by suspension feeders, notably Pomatoceros triqueter. Other sites in the bay had more diverse fauna, fewer suspension feeders, and more omnivores and carnivores. Kelp mass decreased with increasing depth at sites with greater turbidity. The maximum depth of kelp growth was greatest near the sea and decreased as the head of the bay was approached, where sediment deposits, and sediment-rich freshwater was present. (Cassar-FRC)
W81-02215

EVALUATION OF NONPOINT SOURCE SAMPLING, LOADING RATES, AND DATA TRANSFERABILITY FOR AN ESTUARINE DRAINAGE BASIN OF CHESAPEAKE BAY,
Tidewater Administration, Annapolis, MD.
For primary bibliographic entry see Field 5A.
W81-02287

STUDIES OF SALINITY STRATIFICATION IN SOUTHERN LAKE PONTCHARTRAIN NEAR THE INNER HARBOR NAVIGATION CANAL,
New Orleans Univ., LA. Dept. of Biological Sciences.
M. A. Poirrier.
The Proceedings of the Louisiana Academy of Sciences, Vol XLI, p 26-35, December, 1978. 5 Fig, 7 Ref. OWRT-A-041-LA(3).

Descriptors: *Lake Pontchartrain, Physiochemical properties, Chemical analysis, Bioindicators, Invertebrates, Pollutant identification, Water quality, *Estuarine environment, *Estuaries, Saline water-freshwater interfaces, *Salinity, *Stratification, Seasonal, Mixing, *Louisiana.

Stratification was studied at 12 stations located within 10 km of the Inner Harbor Navigation Canal in Southern Lake Pontchartrain, La. Surface and bottom measurements of salinity, temperature and dissolved oxygen were made monthly from July 1976 through June 1977. Salinity stratification occurred in late spring, summer and fall and mixing occurred in winter. Stratification decreased with distance from the canal, and low bottom dissolved xoygen concentrations were found at stratified stations.
W81-02311

THE SALINITY EFFECTS OF DEEPENING THE DREDGED CHANNELS IN THE CHESAPEAKE BAY,
Institute for Water Resources (Army), Fort Belvoir, VA.
D. F. Bastian.
Report NWS-81-S1, December, 1980. 13 p, 6 Fig. Technical Paper presented at Ninth World Dredging Conference, 29-31 October 1980.

Descriptors: *Chesapeake Bay, *Estuaries, *Salinity, *Channel improvement, *Dredging, Channels, Model studies, Channel flow, Hydraulic models, Tidal effects, Mixing, Sediments, Tidal effects.

Tests on the Chesapeake Bay Model, the world's largest estuarine model, were used to assess the effects of increasing the approach channels to Baltimore, Maryland from 13 to 15 m. There are four sections of dredged channels comprising 55 km of the 277 km distance from the bay mouth to Baltimore. The increased depth of channel would extend the length of dredged channels to 79 km. Base tests using the existing 13-m channels were conducted to determine the synoptic velocity, salinity, and tidal conditions at a number of locations throughout the bay, but primarily in the dredged channels. A 2-1/2 year hydrographic period was simulated in the model to enhance the evaluation by adding a variable discharge as a parameter. A 12 constituent harmonic tide was used, giving a 28 lunar day tidal sequence which simulating a lunar month. The entire test was repeated, but with the 15-m channel installed. The tide is far more significant than discharge in affecting the velocities for the stations observed. No shift in flow predominance was identified between base and plan which could be used for conclusions about the effects of depth change on sediment transport. The deepened plan depths appear to induce higher salinities in the Patapsco and surrounding bay area. Salinity differences, base to plan, in this area attenuate with distance from the deepened channels. The model appears to be more saline during the plan test than the base test. (Moore-SRC)
W81-02326

WATER-QUALITY RECONNAISSANCE OF THE PASCAGOULA AND ESCATAWPA RIVERS, JACKSON COUNTY, MISSISSIPPI-MAY 1974 TO JULY 1978,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-02362

PRELIMINARY SIMULATED TIDAL FLOW AND CIRCULATION PATTERNS IN HILLSBOROUGH BAY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. R. Goodwin.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1021, 1980. 25 p, 10 Fig, 4 Ref.

Descriptors: *Estuaries, *Dredging, *Tidal effects, *Model studies, *Florida, Water circulation, *Hillsborough Bay(FL).

The effect of channel dredging and island construction on tidal flow and circulation in Hillsborough Bay, Fla., due to the Tampa Harbor Deepening Project is being investigated using a two-dimensional, finite-difference numerical model. Preliminary model results are presented as a series of maps showing tidal flood, tidal ebb, and circulation patterns in the bay for predredging and postdredging conditions. Complex circulation patterns occur near the bay mouth in an area where there is (1) a change in thalweg alinement of the bay, (2) an intersection of three major ship channels, and (3) submergent and emergent dredged material located adjacent to each of the channels. (USGS)
W81-02363

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3B. Water Yield Improvement

MULTIPLE OBJECTIVES IN RESERVOIR OPERATION,
Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
G. W. Tauxe, D. M. Mades, and R. R. Inman.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 225-238, March, 1980. 3 Fig, 2 Tab, 19 Ref. OWRT-B-105-ILL(5).

Descriptors: *Reservoir evaporation, *Reservoir operation, *Reservoir releases, Water management(Applied), Mathematical models, Optimization, Dynamic programming.

A mathematical model is developed for determining reservoir release policies that maximize cumulative dump energy and minimize cumulative evaporation. Multi-Objective Dynamic Programming (MODP) is used as a technique to analyze objectives which may not be handled as easily or accurately with other optimization methods. The major advantages of this technique are that noncommensurable objective functions can be handled quantitatively, and that trade-off ratios are available between all objectives. Computational feasibility and tractability have been proven, and since the requirement of a single objective function has been eleminated, systems modelling is promoted, as is the capacity for thinking in terms of multiple objectives. As an illustration of MODP, the operation of Shasta Reservoir in California was examined, considering these two objectives. (1) To maximize the cumulation of dump energy generated above a prescribed level of firm energy, and (2) to minimize the cumulative evaporative loss. (Small-FRC)
W81-02156

3C. Use Of Water Of Impaired Quality

SEWAGE SLUDGE AND CARROT WASTES AS SUPPLEMENTARY FEED FOR THE COMMON CARP CYPRINUS CARPIO,
Hong Kong Univ. Dept. of Biology.
M. H. Wong, and S. P. Cheung
Environmental Pollution, Series A: Ecological and Biological, Vol 23, No 1, p 29-39, September, 1980. 6 Fig, 5 Tab, 9 Ref.

Descriptors: *Recycling, *Sludge disposal, Carrots, Carp, Waste disposal, Fish, Nutrients, *Fish food, *Supplementary fish food.

Various amounts of digested sludge or carrot wastes from production of carrot juice were mixed with a control diet and fed to Cyprinus carpio to investigate whether these wastes could be used as supplementary fish feed and to establish appropriate concentrations of these wastes for culturing this economically important species. The six groups receiving the experimental diet were fed the following percentages: 30% carrot waste and 70% control diet; 50% carrot waste and 50% control diet; 80% carrot waste and 20% control diet; 30% sludge and 70% control diet; 50% sludge and 50% control diet; and 80% sludge and 20% control diet. Carp reared on 50% carrot waste were similar to carp fed with control diets exclusively. Carp receiving sludge-supplemented feeds demonstrated adverse effects, including changes in protein and carbohydrate contents of the fish. A high level of various metals was found in the sludge-supplemented diets. It was concluded that carrot wastes, but not sludge, have potential for use as fish food. (Baker-FRC)
W81-02239

3F. Conservation In Agriculture

DEFICIT, HIGH-FREQUENCY IRRIGATION OF SUGARBEETS WITH THE LINE SOURCE TECHNIQUE,
Science and Education Administration, Prosser, WA. Agricultural Research.
D. E. Miller, and A. N. Hang.
Soil Science Society of America Journal, Vol 44, No 6, p 1295-1298, November-December, 1980. 5 Fig, 9 Ref.

Descriptors: *Evapotranspiration, *Irrigation efficiency, *Sugar beets, Sprinkler irrigation, Line source technique, Deficit irrigation, Soil-water-

plant relationships, Crop production, Crop response, Loam, Sand, Pervious soils, Soil types, Plant growth, Water conservation.

Deficit, high frequency (daily) sprinkler irrigation using the line source technique did not decrease sugar yield from sugar beets grown in a loam soil. Water application rates were reduced to 35 to 50% of evapotranspiration (ET) rates without adverse effects. Root yields increased up to 80% ET, then decreased. Sugar yields (14 to 20%) were inversely related to water application. However, in sandy soil, sugar beet root yield increased with water applied, indicating that irrigation rate cannot be decreased much below the leveling-off point, 80% ET. Sugar levels were practically constant, at 17%. (Cassar-FRC)
W81-02213

IRRIGATION EFFICIENCY IN SUGARCANE,
Indian Inst. of Sugarcane Research, Lucknow.
S. R. Prasad, N. S. L. Srivastava, and M. Alam.
Indian Journal of Agricultural Sciences, Vol 50, No 3, p 252-260, March, 1980. 4 Fig, 5 Tab, 3 Ref.

Descriptors: *Irrigation efficiency, *Sugarcane, Furrow irrigation, Efficiencies, Skip furrow irrigation, Irrigation systems, Sugar crops, Agriculture, *India, Water conservation.

Flood, furrow, and skip-furrow irrigation were studied in an effort to find the most water efficient irrigation methods for sugarcane on sandy loam soil in India during 1975-1978. Two irrigation frequencies were included--irrigation at 25% and at 50% of available soil moisture (ASM). Maximum water use efficiency was found with skip-furrow irrigation, which saved an average of 36.5% compared with the flood method. Sugarcane yields (74.20 tons per hectare) from skip-furrowing were highest in one year and on a par with the flood method (61-70 tons per hectare) in other years. Furrow irrigation yielded consistently less cane. Irrigation at 50% ASM produced more cane (in tons per hectare), 64.75 to 76.03, than at 25% ASM, 53.41 to 56.22. Quality of sugarcane juice was unaffected by any variables. (Cassar-FRC)
W81-02243

APPLICATIONS OF THE COMPARTMENTED RESERVOIR IN ARIZONA,
Arizona Water Resources Research Center, Tucson.
For primary bibliographic entry see Field 4A.
W81-02265

GENOTYPE EVALUATION AND MOISTURE REQUIREMENTS FOR CULTIVATED JOJOBA,
Arizona Univ., Tucson. Dept. of Plant Sciences.
L. Hogan, and D. Palzkill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182180, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report, March 10, 1981. 7 p, 1 Tab, 5 Ref. OWRT-A-098-ARIZ(1), 14-34-0001-0103.

Descriptors: *Water requirements, Cold-tolerance, *Cold resistance, *Crop response, Irrigation efficiency, *Water conservation, *Arizona, Test crops, Avra Valley, *Jojoba, Simmondsia chinensis.

Jojoba, Simmondsia chinensis (Link) Schneider is a plant that offers possibilities as a new crop for areas in Arizona where water is scarce and expensive. The Avra Valley is one such area. Two impediments to jojoba cultivation in the Avra Valley are (1) the amount of supplemental irrigation water needed for successful cultivation of jojoba are not known, and (2) planting-stock presently available is not cold-tolerant enough for that area. A study has been initiated to study several irrigation regimes on jojoba performance in this valley and to identify cold-tolerant individuals which could be used for variety improvement. A field planting was established using germplasm from 60 accessions. A drip irrigation system was constructed that allows each of 12 rows in the field to be irrigated independently with small, metered amounts of water. Less than 1/100th of an acre-foot of water was used during the establishment phase of this planting. For all of 3 irrigation intervals studied, a planting depth of 2 inches was found to be superior to shallower or deeper depths. Shallow planting (1 inch) gave poor results with longer irrigation intervals, and the deepest planting (4 inches) gave poor results at all irrigation intervals.
W81-02266

SIMULATING THE WATER REQUIREMENTS AND ECONOMIC FEASIBILITY OF CORN IN THE MIDWEST,
Kentucky Water Resources Research Inst., Lexington.
W. L. Palmer, B. J. Barfield, M. E. Bitzer, and C. T. Haan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182230, Price codes: A10 in paper copy, A01 in microfiche. Research Report No 125, 1981. 205 p, 50 Fig, 11 Tab, 100 Ref. OWRT-B-055-KY(1), 14-34-0001-8088(FY1978).

Descriptors: *Irrigation design, *Crop response, Crop production, Field crops, *Economic feasibility, Economic justification, Scheduling, Water storage, *Irrigation programs, *Corn, *Midwest region, *Simulation model, Crop growth, Water requirements for irrigation, Reservoir size.

An evaluation of the economics of supplemental irrigation when using a surface water supply must be site specific in order to account for variations in soil moisture holding capacity, watershed area supplying the runoff, climatic conditions, and proposed irrigation management procedures. With the use of farm specific simulation models to determine grain yields, availability of irrigation water, and economic expenditures involved in irrigation, an economic evaluation of supplemental irrigation can be performed. In the model presented in this report, the Duncan SIMAIZ model is used to predict grain yields using long-term daily weather information. SIMAIZ also determines irrigation water demand for the crop. The Haan Water Yield Model is used to predict flow into a reservoir using the same weather information. By knowing daily water flow into a reservoir and water demand for irrigation, a reservoir size is determined which will supply water at all times for the study period. Simulations are then run by incrementally reducing, by volume, the size of this reservoir, thus limiting the availability of irrigation water, and resulting in reduced irrigated yields. An economic evaluation is performed for each reservoir size. Costs and benefits are: initial cost of constructing the reservoir, yearly reservoir maintenance cost, yearly irrigation costs of operation, and additional income resulting from the increase in grain yields. This model can be used as a tool for evaluating which irrigation practices, if any, are economically feasible.
W81-02273

HEAT-POWERED WATER PUMP,
Utah State Univ. Foundation, Logan. (Assignee).
D. G. Chadwick.
U.S. Patent No 4,197,060, 5 p, 1 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 993, No 2, p 578, April 8, 1980.

Descriptors: *Patents, *Equipment, *Heat pumps, Solar radiation, Irrigation practices, Heated water, Irrigation efficiency, Heat exchange.

A heat-powered water pump includes a flexible diaphragm as the pumping element with a volatile liquid as a working fluid. The flexible diaphragm is enclosed within a vessel and isolates the working fluid from the water to be pumped. One-way valves control the direction of water flow through the pump. A U-shaped siphon tube acts as a temporary reservoir for the pumped water and is siphoned empty after being filled. A portion of the water siphoned from the U-shaped siphone tube is recirculated through the vessel in heat exchange relationship with the working fluid to condense the working fluid. A reservoir of warm water is maintained in thermal contact with the flexible diaphragm to minimize condensation of the working fluid by thermal contact with the water through the diaphragm. Heat energy from either solar energy or combustion of agricultural wastes is used to vaporize the working fluid. The object of the invention is to provide a heat-powered water pump for use in primitive areas without electrical power to pump irrigation water. (Sinha-OEIS)
W81-02340

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

APPLICATIONS OF THE COMPARTMENTED RESERVOIR IN ARIZONA,
Arizona Water Resources Research Center, Tucson.
C. B. Cluff, and F. Putman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182271, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, January, 1981. 39 p, 10 Fig, 8 Tab, 18 Ref, Append. OWRT-A-082-ARIZ(1), 14-34-0001-8003.

Descriptors: *Water storage, *Water conservation, Evaporation control, *Reservoir design, *Arizona, Irrigation, Compartmented reservoirs, Water supply, Water utilization.

This report contains the results of a one year study to apply the compartmented reservoir concept to water storage problems in Arizona. The range of selected projects was from a ten thousand cubic meter (8.1 af) reservoir for a water harvesting agrisystem at Black Mesa, to a 238 million cubic meter (200,000 af) flood control dam, Tat Momolikot Dam on the Papago Reservation, to supply water for irrigation. Other sites studied were the Santa Cruz River at Continental, to supply an industrial/domestic water, Leslie Creek site for recreation, and improvement of Mormon Lake for recreation. Evaporation from Tat Momolikot and Mormon Lake are presently consuming most of the available water. Through compartmentalization this evaporation can be significantly reduced. At the other potential dam sites on the Santa Cruz and Leslie Creek the use of a compartmented reservoir will make these otherwise marginal projects practical. The Black Mesa Agrisystem is presently demonstrating the utility of the compartmented reservoir system.
W81-02265

CONTAINMENT AREA DESIGN FOR SEDIMENTATION OF FINE-GRAINED DREDGED MATERIAL,
Army Engineers Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 8A.
W81-02324

STAFF REVIEW OF PROPOSED LOCK HAVEN FLOOD PROTECTION PROJECT.
Susquehanna River Basin Commission, Harrisburg, PA. Planning and Operations Div.
For primary bibliographic entry see Field 6B.
W81-02339

AN ANNOTATED BIBLIOGRAPHY OF DEVICES DEVELOPED FOR DIRECT MEASUREMENT OF SEEPAGE,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 10C.
W81-02370

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

REPORT OF THE RIVER MASTER OF THE DELAWARE RIVER FOR THE PERIOD DECEMBER 1, 1978--NOVEMBER 30, 1979,
Geological Survey, Reston, VA. Water Resources Div.
F. T. Schaefer, and R. E. Fish.
Geological Survey Delaware River Master Report, 1980. 94 p, 6 Fig, 19 Tab, Append, 1 Plate.

Descriptors: *Reservoir operation, *Delaware River, *Reservoir storage, *Reservoir releases, *Water quality, New Jersey, New York, Pennsylvania, Hydrologic data, Streamflow, Flow control, Hydrologic budget, Water supply, Water distribution(Applied), Diversion, Estuaries, Water analysis, Saline water intrusion.

Water supply conditions for the year ending November 30, 1979, were above average in the upper Delaware River basin. Combined storage in Pepacton, Cannonsville, and Neversink Reservoirs of the city of New York was 87.1% of capacity on that date. Diversions for water supply for New York City for the year averaged 735 million gallons per day, compared to a maximum allowable rate of 800 million gallons per day. Releases were designed to maintain a flow of 1,750 cubic feet per second at the U.S. Geological Survey gaging station, Delaware River at Montague, N.J. Augmented conservation releases were made, at times, on an experimental basis for the purpose of enhancing environmental characteristics in the stream segments downstream from the reservoirs. Diversions by the State of New Jersey were less than the authorized monthly average of 100 million gallons per day and less than the authorized maximum daily diversion of 120 million gallons per day. Water quality of the Delaware River and Estuary was monitored on a continuous basis at eight sites and on a monthly basis at ten sites. (USGS)
W81-02373

4B. Groundwater Management

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN HANSFORD COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
A. E. Bell, and S. Morrison.
Report 257, October, 1980. 64 p, 18 Tab, 76 Ref, 24 Maps.

Descriptors: *Texas, *Aquifers, *Groundwater, *Recharge, *Water table, *Irrigation, Storage depletion, Water wells, Data collections, Computer programs, Digital computers, Rainfall, Storage coefficient, Porosity, *Ogallala aquifer, Hansford County.

An annual overdraft that is approximately eleven times the rate of natural recharge to the Ogallala aquifer could lead to severe water shortages in Hansford County. Wateruse patterns between 1960 and 1972 as reflected in water level changes in wells measured in the High Plains of Texas were used as the principal data source for developing an aquifer depletion schedule. Based on this depletion schedule, a computer program was written to calculate future saturated thickness and individual well sites. Because the Ogallala is not a homogenous formation, the thickness of layers, layering position, and grain-size sorting will affect well-yields. An electronic digital computer was used to construct maps which reflect the saturated thickness of the aquifer for those years included in the study. Estimates of current pumpage were obtained by calculating the storage capacity of the dewatered section of the aquifer as reflected in changes in the annual depth-to-water measurements made in the water level observation wells. Factors for natural recharge and irrigation recirculation were then added to these volumetric figures to obtain more realistic pumpage estimates. Using maps, charts, and tabulations, this report makes projections, but not absolute predictions, about aquifer depletion. (Garrison-Omniplan)
W81-02336

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN OCHILTREE COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
A. E. Bell, and S. Morrison.
Report 258, October, 1980. 64 p, 18 Tab, 24 Maps.

Descriptors: *Texas, *Aquifers, *Groundwater, *Water table, *Recharge, Irrigation, Pumping, Test wells, Overdraft, Storage depletion, Data collection, Computer programs, Storage coefficient, Digital computers, Dewatering, *Ogallala aquifer, Ochiltree County.

The distribution of groundwater in Ochiltree County is very uneven. Historical pumpage has exceeded 175,000 acre-feet annually, which is approximately eight times the rate of natural recharge to the Ogallala aquifer in this county. Included in this report are projections of saturated thickness, the volume of water in storage, pumpage rates, pumping lifts, and well yields in Ochiltree County, which produces a total annual farm income of over $50 million. Water-use patterns between 1960 and 1972 were used to develop an aquifer depletion schedule, and a computer program was written to calculate future saturated thickness at individual well sites. To estimate the volume of water storage in the Ogallala, an electronic digital computer was used to construct maps which reflect the saturated thickness of the aquifer Estimates of current pumpage were also obtained by calculating the storage capacity of the dewatered section of the aquifer as reflected in changes in the annual depth-to-water measurements made in the water level observation wells. Factors for natural recharge and irrigation circulation were then added to these volumetric figures to obtain more realistic pumpage estimates. Because some areas in Ochiltree County were found to have a short supply of groundwater, conservation is strongly recommended. (Garrison-Omniplan)
W81-02337

COMPUTER-MODEL ANALYSIS OF THE USE OF DELAWARE RIVER WATER TO SUPPLEMENT WATER FROM THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM IN SOUTHERN NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 6A.
W81-02348

HYDROLOGIC MONITORING PROGRAM IN ELDRIDGE-WILDE AND EAST LAKE ROAD WELL-FIELD AREAS, PINELLAS AND HILLSBOROUGH COUNTIES, FLORIDA, 1978,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02350

HYDROGEOLOGIC DATA FOR SOUTH CENTRAL CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02356

GROUNDWATER DATA, 1969-77, VANDENBERG AIR FORCE BASE AREA, SANTA BARBARA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02359

PLANNING REPORT FOR THE SOUTHWEST ALLUVIAL BASINS (EAST) REGIONAL AQUIFER-SYSTEM ANALYSIS, PARTS OF COLORADO, NEW MEXICO, AND TEXAS,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 6A.
W81-02360

WATER RESOURCES OF THE PORT GAMBLE INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
W. E. Lum, II.
Geological Survey Open-File Report 79-66 (WRI), 1980. 52 p, 11 Fig, 9 Tab, 14 Ref.

Descriptors: *Water resources, *Indian reservations, *Washington, Available water, *Water quality, Surface waters, Groundwater potential, Aquifer characteristics, Hydrogeology, Water yield, Water demand, Chemical analysis, Water supply, *Port Gamble Indian Reservation(WA), Kitsap County(WA), Western Washington

A study of the water resources of the Port Gamble Indian Reservation, Wash., has shown that there is probably a substantial quantity of good quality ground and surface water available to provide for further development of the reservation. Groundwater supplies are available from an artesian aquifer underlying the reservation near sea level This aquifer is estimated to be capable of supplying at least 90 gallons per minute, continuously, without greatly increasing chances for seawater intrusion. This quantity of water is enough to supply about 800 to 900 additional residents on the reservation. Another artesian aquifer, relatively unexplored, was noted underlying the previously mentioned artesian aquifer. This lower aquifer may be capable of supplying additional groundwater for use on the reservation. Groundwater quality was found to be good for most uses, being moderately hard and having moderately high iron concentrations. No evidence of pollution of the groundwater was found during this study from either seawater intrusion or contamination from a nearby solid-waste disposal site. Surface-water resources studied on the reservation included two streams, Middle and Little Boston Creeks, whose 7-day low flows were estimated to be 0.4 and 0.2 cubic foot per second, respectively, for a 20-year estimated recurrence interval. The surface-water quality was also found to be good for most uses and was within the limits established by the U.S. Environmental Protection Agency for untreated drinking water Thus, the water from these two streams, Middle and Little Boston Creeks, could be used as domestic supplies to supplement the groundwater withdrawals. (USGS)
W81-02365

RECONNAISSANCE OF GROUNDWATER IN THE VICINITY OF GUNNISON AND CRESTED BUTTE, WEST-CENTRAL COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
T. F. Giles.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225. Price: $7.00 in paper copy, $1.00 in microfiche. Geological Survey Open-File Report 80-12 (WRI), May, 1980. 23 Ref, 2 Sheets.

Descriptors: *Groundwater resources, *Aquifers, *Water supply, *Water quality, *Colorado, Hydrogeology, Hydrologic data, Maps, Groundwater availability, Water wells, Well data, Water yield, Hydraulic systems, Aquifer characteristics, Groundwater movement, Geohydrologic units, Water quality standards, Chemical analysis, West-central Colorado, Gunnison-Crested Butte area(CO).

Hydrologic data was collected in the Gunnison-Crested Butte area, Colo., to determine the availability and chemical quality of groundwater. Parts of the area have undergone rapid population growth in recent years due to an increase of winter sports activities. This rapid growth has resulted in a demand for additional domestic, recreational, and municipal water supplies. Maximum yields of 100 gallons per minute are available from wells completed in the alluvial aquifers while as much as 60 gallons per minute may be obtained from wells completed in the Dakota and Entrada Sandstones

Yields from other aquifers generally are less than 25 gallons per minute. Calcium magnesium bicarbonate water is the predominant water type in the study area. Dissolved solids concentrations ranged from 30 to 829 milligrams per liter and hardness ranged from 18 to 400 milligrams per liter. (USGS)
W81-02381

HYDRAULIC CHARACTERISTICS OF AN UNDERDRAINED IRRIGATION CIRCLE, MUSKEGON COUNTY WASTE WATER DISPOSAL SYSTEM, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-02388

WATER-RESOURCES DATA COLLECTED IN THE DEVILS HOLE AREA, NYE COUNTY, NEVADA, 1977-78,
Geological Survey, Carson City, NV. Water Resources Div.
R. L. Carson.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $2.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-772, 1980. 15 p, 8 Fig, 2 Tab, 8 Ref.

Descriptors: Data collections, *Hydrogeology, *Irrigation wells, *Pumping, *Environmental effects, *Nevada, Water wells, *Water level fluctuations, Springs, Irrigation effects, Fish, *Devils Hole area(NV), *Pupfish.

This report presents water data collected at Devils Hole, Nev., and vicinity for July 1977 through June 1978 to observe the effects of irrigation pumping on the pool level in Devils Hole. The pool contains the endangered species of pupfish, Cyprinodon diabolis. The report presents data on fluctuations in water level and springflow in graphic form, and tabulates electric energy consumed by irrigation wells as an index of the pumpage. (USGS)
W81-02391

CHEMICAL AND MICROBIOLOGICAL MONITORING OF A SOLE-SOURCE AQUIFER INTENDED FOR ARTIFICAL RECHARGE, NASSAU COUNTY, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
B. G. Katz, and G. E. Mallard.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $2.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-567, 1980. 18 p, 4 Fig, 5 Tab, 19 Ref.

Descriptors: *Monitoring, *Chemical analysis, *Microbiology, *Reclaimed water, *Artificial recharge, Injection wells, Storm runoff, Aquifer characteristics, Groundwater, Groundwater recharge, Water table, Water quality, Water supply, New York, *Long Island(NY).

In late 1980, approximately 4 million gallons per day of highly treated wastewater will be used to recharge the groundwater reservoir in central Nassau County through a system of 10 recharge basins and 5 shallow injection wells. To evaluate the impact of large-scale recharge with reclaimed water on groundwater quality, the U.S. Geological Survey has collected hydrologic and water-quality data from a 1-square-mile area around the recharge site to provide a basis for future comparison. Extensive chemical and microbiological analyses are being made on samples from 48 wells screened in the upper glacial (water-table) aquifer and the upper part of the underlying Magothy (public-supply) aquifer. Preliminary results indicate that water from the upper glacial aquifer contains significant concentrations of nitrate and low-molecular-weight chlorinated hydrocarbons and detectable concentrations of organochlorine insecticides and polychlorinated biphenyls. At present, no fecal contamination is evident in either aquifer in the area studied. In the few samples containing fecal indicator bacteria, the numbers were low. Nonpoint sources provide significant loads of organic and inorganic compounds; major sources include cesspool and septic-tank effluent, cesspool and septic-tank cleaners and other over-the-counter domestic organic solvents, fertilizers, insecticides for termite and other pest control, and stormwater runoff to recharge basins. The water-table aquifer is composed mainly of stratified, well-sorted sand and gravel and, as a result, is highly permeable. In the 1-square-mile area studied, some contaminants seem to have traveled 200 feet downward to the bottom of the water-table aquifer and into the upper part of the public-supply aquifer. (USGS)
W81-02393

4C. Effects On Water Of Man's Non-Water Activities

A LOCAL URBAN PERSPECTIVE ON NONPOINT POLLUTION CONTROL,
Montgomery County Council, Rockville, MD.
For primary bibliographic entry see Field 5G.
W81-02282

TECHNIQUE FOR ESTIMATING THE MAGNITUDE AND FREQUENCY OF FLOODS IN THE HOUSTON, TEXAS, METROPOLITAN AREA,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 6F.
W81-02347

HYDROLOGIC DATA FOR URBAN STUDIES IN THE SAN ANTONIO, TEXAS METROPOLITAN AREA, 1977,
Geological Survey, Austin, TX. Water Resources Div.
R. Perez, and L. Harmsen.
Geological Survey Open-File Report 80-743, June, 1980. 100 p, 1 Fig, 6 Tab, 5 Ref.

Descriptors: *Urban hydrology, *Rainfall-runoff relationships, *Storm runoff, *Urban runoff, Hydrologic data, Small watersheds, Streamflow, Flow rates, Peak discharge, Flood profiles, Watershed management, *Texas, San Antonio(TX).

This report contains rainfall, runoff, and water-quality data collected during the 1977 water year for the San Antonio, Tex., metropolitan area. The information will be useful in determing the effects of various stages of urbanization on flood discharge and runoff and in determining chemical constituents in surface-water runoff from floods of various magnitudes during all seasons of the year from areas with different types of utilization. Detailed rainfall-runoff computations are presented for several storm periods during the 1977 water year. (USGS)
W81-02390

4D. Watershed Protection

BUILDING WATER QUALITY OBJECTIVES INTO CONSERVATION PLANNING MODELS,
Economics and Statistics Service, Broomall, PA.
C. W. Ogg.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 129-134, 1981. 1 Fig, 15 Ref.

Descriptors: *Nonpoint pollution sources, *Pennsylvania, *Model studies, *Computer models, Mathematical models, Erosion, Environmental effects, Agricultural runoff, Land use, *Erosion control, Sedimentation, Phosphorus, Pesticides, Linear programming.

A linear programming water quality model was modified to make it applicable to rural nonpoint pollution control programming in south eastern Pennsylvania. The model uses the Universal Soil Loss Equation and the Williams equation to estimate delivered sediment and runoff for each soil-land use combination. The estimates are broken down by farming activities and are used to estimate dissolved and absorbed chemical losses. Aggregates of these losses provide watershed level estimates. In the model tableau, each column represents a different soil agronomic complex. The model has rows for objectives, production, land resources, environment, and technology. The rows for runoff values and sediment values allow the design of more efficient strategies for reducing sediment loads. The model is primarily suited to designing the most efficient affordable management strategy once the need for handling of nonpoint sources has been established. The model's major limitation is in the area of estimating total nonpoint versus point sources of pollution. (See also W81-02276) (Seigler-IPA)
W81-02293

EVALUATION AND REVISION OF SEDIMENT AND EROSION CONTROL PROGRAMS IN URBANIZING AREAS FOR NONPOINT SOURCE MANAGEMENT,
Regional Planning Council, Baltimore, MD.
For primary bibliographic entry see Field 6B.
W81-02297

EFFECTIVENESS OF BEST MANAGEMENT PRACTICES IN CONTROLLING NONPOINT POLLUTION FROM COMMERCIAL CLEARCUTS,
Pennsylvania State Univ., University Park. Coll. of Agriculture.
J. A. Lynch, and E. S. Corbett.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 213-224, 1981. 3 Fig, 5 Tab, 6 Ref.

Descriptors: *Pennsylvania, *Best management practices, *Nonpoint pollution sources, *Forest management, Erosion control, Soil conservation, Herbicides, Monitoring, Forestry, *Lumbering, Clear-cutting, Watershed management, Runoff, Sediments.

A commercial clearcut experiment and a clearcut-herbicide experiment were conducted on the Leading Ridge Experimental Watersheds, three adjacent watersheds in central Pennsylvania, to study the relationship between silviculture practices and nonpoint pollution. All three watersheds were equipped with modified broad-crested Trenton weirs to measure stream discharge. For the clearcut-herbicide experiment, the smallest watershed was clearcut in three progressive phases, lower slope (1967), middle slope (1972), and upper slope (1976). Herbicides were used to eliminate revegetation after the second and third cuts so that comparisons between phases could be made. For the commercial clearcut experiment, 110 acres of the 257 acre watershed were harvested using Pennsylvania's 'Best Management Practices'. Results within two years after the commercial clearcut show that the Pennsylvania 'Best Management Practices' were sufficient to control nonpoint source pollution during and following logging. Changes in concentrations of nutrients studied were superficial and the total impact was slight and perhaps beneficial. The herbicide clearcut did produce significant deleterious environmental changes. (See also W81-02276) (Seigler-IPA)
W81-02300

BALANCING PUBLIC AND PRIVATE CONTROLS AT THE SUBURBAN COUNTY LEVEL,
Adams County Board of Commissioners, Brighton, CO.
J. L. Colt, and J. T. Smullen.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 259-266, 1981. 3 Fig.

Descriptors: *Colorado, *Urban runoff, *Nonpoint pollution sources, *Erosion control, Inspection, Percolation, Construction sites, Cities, Storm runoff, Urban drainage, Building codes, Land use, Zoning, Mapping.

The Adams County, Colorado Board of Commissioners worked extensively with the Denver

Region Council of Governments to develop a county plan for local urban runoff problems. The County's jurisdictional area is large, 1,268 sq mi, with considerable suburban population and housing growth. Early efforts were made to encourage land development in areas that were either less erodible, or more deeply permeable. The Adams County program is predominantly nonstructural, inexpensive to implement, and is designed to appeal to the small land developer. The program is expressed in relatively simple logic so that it is readily understandable. Percolation studies were conducted and best management practices to enhance percolation systems were recommended. Single-standard controls for limiting erosion and sediment from construction sites were developed rather than the typical 'sliding scale' ordinances. Surface erodibility and fertility maps were prepared to indicate the level of control needed for an area. The control program is enjoying local public acceptance and popularity. (See also W81-02276) (Seigler-IPA)
W81-02304

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, APPENDIX B, SEDIMENT AND RELATED ANALYSIS, FINAL.
Frederiksen, Kamine and Associates, Sacramento, CA.
For primary bibliographic entry see Field 6G.
W81-02331

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DETERMINATION OF CHLOROBENZENES IN WATER BY CAPILLARY GAS CHROMATOGRAPHY,
Canada Centre for Inland Waters, Burlington (Ontario).
B. G. Oliver, and K. D. Bothen.
Analytical Chemistry, Vol 52, No 13, p 2066-2069, November, 1980. 3 Fig, 3 Tab, 11 Ref.

Descriptors: *Chlorobenzenes, *Pollutant identification, *Water analysis, Organic compounds, Analytical techniques, Chromatography, *Gas chromatography.

Chlorobenzenes in water samples were concentrated 1,000 and 2,500 times into pentane, using Chromosorb 102 or liquid-liquid extraction with pentane, respectively. The capillary gas chromatography-electron capture detection method was used to quantitate all 12 chlorobenzenes. Detection limits were (in nanograms per liter): 0.01 for penta- and hexachlorobenzene, 0.05 for tetrachlorobenzenes, 0.1 for trichlorobenzenes, 1 for dichlorobenzenes, and 500 for monochlorobenzene. (Cassar-FRC)
W81-02154

FLOW INJECTION ANALYSIS USING POTASSIUM PERMANGANATE: AN APPROACH FOR MEASURING CHEMICAL OXYGEN DEMAND IN ORGANIC WASTES AND WATERS,
Okayama Univ. (Japan). School of Engineering.
T. Korenaga.
Analytical Letters, Vol 13, No A11, p 1001-1011, 1980. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Analytical technique, *Chemical oxygen demand, *Equipment, Organic matter, Spectrophotometry, Municipal wastes, Rivers, Flow injection analysis.

A rapid and continuous analytical method based on flow injection analysis was developed for the determination of COD due to organic substances in polluted water. The apparatus uses a double reciprocating micro-pump, a constant-volume sampling valve, a spectrophotometer, a recorder, and various lengths of polytetrafluoroethylene tubing. Potassium permanganate and sulfuric acid solutions were individually pumped up as oxidizing agents, and glucose was used as a standard substance. All samples were filtered with a 0.45 micron pore size membrane filter, and dissolved COD substances were measured. Municipal sewage, human wastes, and river water were examined, and COD values agreed with those obtained using the JIS method within the permissible error range of + or - 30%. (Small-FRC)
W81-02165

FACTORS TO CONSIDER IN ORGANIZING SAMPLING AND ANALYSES FOR PRIORITY POLLUTANTS IN WASTE WATERS,
National Council of the Pulp and Paper Industry for Air and Stream Improvement, Inc., Gainesville, FL.
R. P. Fisher, and R. R. Claeys.
Tappi, Vol 64, No 1, p 63-66, January, 1981. 6 Ref.

Descriptors: *Sampling, *Pulp and paper industry, *Pollutant identification, Analytical techniques, Industrial wastes, Mercury, Trace metals, Chemical analysis, Laboratory tests, Water analysis, Chromatography, Pulp wastes, *Waste water.

Analysis of pulp and paper waste waters for toxic pollutants by independent firms under contract involves several factors. The contract analytical lab should have gas chromatography/mass spectrometry capabilities to perform analyses by Series 624 and 625 methods, have specific experience in the pulp and paper industry, and be EPA approved. The practice of sub-contracting some of the work can give rise to communication problems. Sample collection may be done by two contractors to assure blind replicates. Precautions in sample collecting involve use of medical grade silicone rubber tubing and suitable containers--borosilicate vials or bottles for organic samples, polyethylene bottles for trace element samples. The importance of sample preservation is emphasized. Volatile organics must be kept at 4C for no greater than 7 days; trace metal and mercury samples must be acidified with nitric acid. (Cassar-FRC)
W81-02179

RELIABILITY OF AN ELECTRODE AND A WATER ANALYSIS KIT FOR DETERMINATION OF AMMONIA IN AQUACULTURE SYSTEMS,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
M. L. Cuenco, and R. R. Stickney.
Transactions of the American Fisheries Society, Vol 109, No 5, p 571-576, September, 1980. 5 Tab, 13 Ref.

Descriptors: *Water analysis, *Ammonia, *Aquaculture, *Electrodes, Analytical techniques, Fish, Shrimp, *Pollutant identification.

Total ammonia nitrogen (TAN) was determined by an ammonia electrode and by the nesslerization procedure in a Hach water quality test kit in standard solutions, well water, and water from several aquaculture systems. The ammonia electrode performed well in the analysis of standard solutions and water from aquaculture systems. Distillation did not improve accuracy or precision when used with raw water samples, but TAN concentrations were affected by interferences from high alkalinity and iron when water from some wells was analyzed without distillation. The Hach test kit showed less precision and accuracy in the standard solution analysis, producing consistently higher readings. This is of little significance at higher levels (10 mg per liter), but at concentrations around 1 mg per liter the results could cause unwarranted concern. The test kit gave poorer results in raw water samples enriched with manure and in the undistilled high alkaline, high iron water samples. (Cassar-FRC)
W81-02180

STUDIES ON THE TOXICITY OF PULP AND PAPER MILL EFFLUENTS - II. MUTAGENICITY OF THE EXTRACTS OF THE LIVER FROM SPOTTED SEA TROUT (NIBEA MITSUKURII),
Shizuoka Coll. of Pharmaceutical Sciences (Japan).
N. Kinae, T. Hashizume, T. Makita, I. Tomita, and I. Kimura.
Water Research, Vol 15, No 1, p 25-30, January, 1981. 5 Fig, 7 Tab, 4 Ref.

Descriptors: *Trout, *Toxicity, *Pulp wastes, Fisheries, Fish, Effluent, Industrial wastes, Genetics, Water pollution sources, Assay, Analytical techniques, Pollutant identification, Evaluation, Mass spectrometry, Gas chromatography, Pulp and paper industry.

Ether extracts of the livers of tumor-bearing fish from coastal waters in the vicinity of pulp and paper mill discharges were assayed for mutagenic substances. Assays using S. typhimurium followed by the fractionation of the extract by high-speed liquid chromatography (HLC) revealed the presence of mutagenic compounds. Twelve compounds identical to those identified in sediments from the vicinity were found, including 9,10-epoxystearic acid. (Titus-FRC)
W81-02183

USE OF AN IN SITU ARTIFICIAL SUBSTRATE FOR BIOLOGICAL ACCUMULATION AND MONITORING OF AQUEOUS TRACE METALS--A PRELIMINARY FIELD INVESTIGATION,
Academy of Natural Sciences, Philadelphia, PA.
S. L. Friant, and H. Koerner.
Water Research, Vol 15, No 1, p 161-167, January, 1981. 2 Fig, 3 Tab, 19 Ref.

Descriptors: *Bioindicators, *Trace elements, Metals, *Algae, Diatometer, Diatoms, *Pollutant identification, Water pollution, Chromium, Water analysis, Zinc, Copper, Mercury, Antimony, Food chains, *Heavy metals.

The diatometer, which consists of glass slides upon which indigenous aquatic microflora can attach and grow, was used in trace metal measurements in river water near a synthetic fiber manufacturing plant. Substrates were exposed for 2 week periods during the 6 month study. Concentrations of Cr, Cu, Hg, and Sb were the same in sediment samples above and below the plant waste water outfall. However, Zn concentration was very slightly higher below the outfall. The diatometer results were similar to sediment results with the exception of significantly higher Cr levels in water near the outfall. Cr is the only metal studied in this work which is known to be a constituent of the plant discharge. Thus the algae growing on the artificial substrate accumulated metals present in the water, rather than from the sediment, and were a more realistic indicator of a point source than were sediment samples. (Cassar-FRC)
W81-02192

A BIOASSAY APPLICATION FOR QUANTITATIVE TOXICITY MEASUREMENTS, USING THE GREEN ALGAE SELENASTRUM CAPRICORNUTUM,
G. Joubert.
Water Research, Vol 14, No 12, p 1759-1763, December, 1980. 1 Fig, 2 Tab, 26 Ref.

Descriptors: *Bioindicators, *Toxicity, *Chlorophyta, *Bioassay, Water analysis, Industrial wastes, Toxins, Measurement.

A bioassay method is proposed for toxicity value based on Selenastrum capricornutum, a sensitive organism belonging to the first link in the food chain. A toxic dose of a substance contained in a water sample inhibited the algae population, the effect was one of no growth. Even when incubation periods were extended to 14, 18, 21 and 25 days, no significant increases in cell counts were observed. The method is a simple and inexpensive tool for evaluating liquid samples. Sufficient nutrients to enable the growth of a biomass of 50 mg of algae must be added to the sample to prevent error. Other freshwater unicellular algae such as Chlorella were also successfully used. Of course, the test cannot measure the effects of ammonia or phosphorus as toxicants, but this is a minor incon-

venience. The test can be applied to industrial wastes and samples from the natural environment. Its major advantage is that it permits a quantitative assessment of toxicity; it is possible to express toxicity in the number of toxic units as defined by Sprague and Ramsey (1965). (Small-FRC)
W81-02194

ECOLOGICAL STUDIES OF THE KELP, LAMINARIA HYPERBOREA, AND ITS ASSOCIATED FAUNA IN SOUTHWEST IRELAND,
Cambridge Univ. (England). Zoological Lab.
For primary bibliographic entry see Field 2L.
W81-02215

ALGAL ASSAY STUDIES OF WASTE WATER POLLUTED LAKES,
National Swedish Environment Protection Board, Uppsala. Algal Assay Lab.
A. Claesson, and A. Forsberg.
Archiv fur Hydrobiologie, Vol 89, No 1/2, p 208-224, June, 1980. 5 Fig, 3 Tab, 17 Ref.

Descriptors: *Algae, *Waste water(Pollution), *Eutrophication, Nitrogen compounds, Phosphorus compounds, Bioassay, Nutrients, Chlorophyll, *Sweden, Aquatic algae, Limnology, Pollutant identification, *Lakes, Water pollution, Growth rates, Water quality, Trace elements.

Twenty-nine Swedish lakes receiving waste waters were monitored weekly during the growing seasons (June-September) of 1972-1975 with measurements of chlorophyll a and nutrients. Although the total chlorophyll variations usually followed the total nitrogen and total phosphorus variations, the algal growth potential did not always correspond with the limiting nutrient content. N was most growth limiting in 57% of the samples, P in 32%, and both in 11%. The lakes were classified as follows: 16 N-limited, 9 P-limited, and 4 N+P-limited. Occasionally EDTA and/or trace elements were found to be limiting factors. When samples were grouped as above, correlations were found between inorganic nutrients and algal growth potential and between total nutrients and total chlorophyll. In lake water samples with N/P quotients below 10, N was the limiting nutrient, and in samples with quotients above 18, P was limiting. (Cassar-FRC)
W81-02224

MERCURY ACCUMULATION IN BIOTA OF THUNDER CREEK, SASKATCHEWAN,
Saskatchewan Dept. of the Enviroment, Regina. Inland Waters Directorate.
D. J. Munro, and W. D. Gummer.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 6, p 884-890, December, 1980. 1 Fig, 3 Tab, 9 Ref.

Descriptors: *Mercury, *Aquatic animals, *Crayfish, *Fish, *Food chains, Bioindicators, Crustaceans, Thunder Creek, Canada, Invertebrates, Pollutant identification, Sediments, Path of pollutants, *Saskatchewan.

Crayfish and fish were collected in Thunder Creek, Saskatchewan, to determine the mercury levels in the food chain. High levels of Hg (up to 89 mg per kg) had previously been determined in sediment from this creek at the downstream sampling location. The upstream site served as a control. Crayfish contained an average of 0.22 mg per kg at the downstream site and 0.08 mg per kg at the upstream control location. Brook stickleback had an average mercury concentration of 0.09 mg per kg upstream and 0.15 mg per kg downstream; pearl dace, 0.03 mg per kg upstream and 0.07 mg per kg downstream. (Cassar-FRC)
W81-02228

ADHESION-BINDING OF 2,2',4,4',5'5'-HEXACHLOROBIPHENYL TO GLASS AND PLASTIC: A POSSIBLE SOURCE OF ERROR FOR PCB ANALYSIS,
Fordham Univ., Bronx, NY.
M. G. Pepe, and J. J. Byrne.
Bulletin of Environmental contamination and Toxicology, Vol 25, No 6, p 936-940, December, 1980. 3 Tab, 8 Ref.

Descriptors: *Polychlorinated biphenyls, *Analytical techniques, *Pollutant identification, Adsorption, Sedimentation.

Polychlorinated biphenyls (PCB) in aqueous solution were adsorbed by glass tubes and plastic tubes during storage tests. This indicated a possible source of error in determination of PCB in stored samples. A solution of 2,2',4,4',5,5'-C14-hexachlorobiphenyl in borosilicate glass culture tubes contained 1.18 ppm at the onset of the storage tests, 1.21 after 1 hour, 1.16 after 24 hours, 0.98 after 48 hours, 0.81 after 72 hours, and 0.41 after 144 hours. A similar test with plastic centrifuge tubes showed a decline from 1.16 ppm at zero hours to 0.12 at 144 hours. In the glass tubes, where sedimentation was predominant, 17 times more PCB was found at the bottom than on the side. The ratio of bottom to wall adsorption was 1.5 in the plastic tubes. When tubes were wiped and washed with ethanol, only 78.3% of the known PCB content was recovered from the glass tubes and 91.7% from the plastic tubes. (Cassar-FRC)
W81-02229

SPECTRAL ABSORPTION PROPERTIES OF NATURAL WATERS: CONTRIBUTION OF THE SOLUBLE AND PARTICULATE FRACTIONS TO LIGHT ABSORPTION IN SOME INLAND WATERS OF SOUTH-EASTERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 2H.
W81-02235

RELATIONSHIP BETWEEN NEPHELOMETRIC TURBIDITY AND SCATTERING COEFFICIENTS IN CERTAIN AUSTRALIAN WATERS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
J. T. O. Kirk.
Australian Journal of Marine and Freshwater Research, Vol 31, No 1, p 1-12, March, 1980. 3 Fig, 4 Tab, 9 Ref.

Descriptors: *Turbidity, *Light penetration, *Scattering coefficient, *Attenuation, Australia, Surface waters, Mathematics, Suspended solids.

Light scattering coefficients, difficult to measure, may be approximated by using the ratio of the asymptotic (maximum) backscattering coefficient to the normal backscattering and total scattering coefficients for different types of natural waters. A linear relationship was determined between measured nephelometric turbidity and the value of 2 times the asymptotic value of underwater irradiance reflectance times the vertical attentuation coefficient of irradiance. (Cassar-FRC)
W81-02236

A SEQUENCING SEDIMENT TRAP FOR TIME-SERIES STUDIES OF FRAGILE PARTICLES,
Woods Hole Oceanographic Institution, MA. Dept. of Chemistry.
H. W. Jannasch, O. C. Zafiriou, and J. W. Farrington.
Limnology and Oceanography, Vol 25, No 5, p 939-943, September, 1980. 1 Fig, 1 Tab, 13 Ref.

Descriptors: *Sedimentology, *Sampling, *Instrumentation, On-site tests, *Sediment transport, Particle size, *Time series analysis.

A relatively simple sediment trap has been developed and tested in Buzzards Bay, Massachusetts, to collect up to 8 samples at equal intervals from 22.5 min to 256 days at pressures up to 600 atmospheres. The trap consists of a cylindrical trap unit 76 cm long and 25 cm diameter containing a sample-concentrating funnel (70 degree cone) at the bottom, 8 underlying sampling jars on an externally motor-operated turntable, and a pressure-tight electronics package. Viscous polymers such as polyacrylamide may be used to trap and preserve the sediment particles. (Cassar-FRC)
W81-02244

SEMIAUTOMATED DETERMINATION OF TOTAL PHOSPHORUS AND TOTAL KJELDAHL NITROGEN IN SURFACE WATERS,
Ontario Ministry of the Environment, Rexdale. Water Quality Branch.
J. Crowther, B. Wright, and W. Wright.
Analytica Chimica Acta, Vol 119, No 2, p 313-321, 1980. 1 Fig, 3 Tab, 4 Ref.

Descriptors: *Analytical techniques, *Nitrogen, *Phosphorus, Water quality control, Chemical analysis, Nutrients, Surface waters, Spectrometry.

A system was developed for precise and productive measurement of low levels of nitrogen and phosphorus in surface waters. A block digester with a temperature control unit was used to digest 40 samples simultaneously. For automated sample neutralization and colorimetric measurements a dual-channel AutoAnalyzer system was employed, consisting of a sampler, peristaltic pump, constant temperature unit, and two AAII colorimeters equipped with 50-mm flow cells. One colorimeter was filled with 630-nm filters, while the other had 880-nm filters. A second analytical system was used to validate the first system. By calibrating the AutoAnalyzer system with undigested standards, the data for digested standards were made to serve as a recovery check on the whole system. Twenty-four samples could be processed per hour. Common anions and cations were tested as potential interferences, but no problems were encountered. The increased productivity associated with the proposed system was reached without any significant loss in accuracy or precision. (Baker-FRC)
W81-02248

DETERMINATION OF URANIUM BY THERMAL AND EPITHERMAL NEUTRON ACTIVATION IN NATURAL WATERS AND IN HUMAN URINE,
Dalhousie Univ., Halifax (Nova Scotia). Chemistry Dept.
J. Holzbecher, and D. E. Ryan.
Analytica Chimica Acta, Vol 119, No 2, p 405-408, 1980. 1 Tab, 4 Ref.

Descriptors: *Analytical techniques, *Uranium, *Neutron activation analysis, Urine, Water quality control, Natural waters.

Thermal and epithermal neutron activation methods developed to detect uranium in natural waters and in human urine are described. All samples were acidified at time of collection. Aliquots of water samples were sealed in 2/5 dram vials. For preconcentration, acetate buffer of pH 5.2 was added to 100-ml samples followed by 2 ml of the aqueous oxine solution under stirring. The solution was heated and activated carbon suspension was added with rapid stirring. The suspension was stirred while cooling. The powder was filtered off with suction, washed and dried. It was then transferred to a polyethylene vial and sealed. Recoveries were always greater than 80%. Uranium was determined via its U-239 nuclide. For thermal activation the inner reactor core site was used while epithermal activation was done in the outer site of the reactor. Uranium concentrations in the collected water samples ranged from 11 to 143 ng/ml. Results show a large difference in uranium concentrations depending on the collection site within a relative small area, but even the lowest result is well above normal values for natural waters. Thus uranium in fresh natural waters can be determined in concentrations above 4 ngU/ml after short irradiation and counting times. For lower concentrations preconcentration with activated carbon and oxine is employed. (Baker-FRC)
W81-02249

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

AQUATIC MACROPHYTES AS INDICATOR FOR HEAVY METAL POLLUTION IN THE RIVER LEINE (WEST GERMANY). (MAKROPHYTISCHE WASSERPFLANZEN ALS BIOINDIKATOREN FUR DIE SCHWERMETALL-BELASTUNG DER OBEREN LEINE),
Institut fuer Physische Geographie, Frankfurt-am-Main (Germany, F.R.).
M. D. K. Abo-Rady.
Archiv fur Hydrobiologie, Vol 89, No 3, p 387-404, July, 1980. 3 Fig, 8 Tab, 33 Ref. (English abstract).

Descriptors: *Heavy metals, *Leine River, *Bioindicators, *Aquatic plants, Water pollution effects, Water pollution sources, Pollutant identification, Standards, Cadmium, Copper, Mercury, Nickel, Lead, Zinc, Metals, Goettingen, *West Germany, Water quality, Rivers.

Cladophora glomerata was the most promising of 4 aquatic macrophytes tested as bioindicators for heavy metals in river water. Other species used were Potamogeton pectinatus, Zannichellia palustris, and Phalaris arundinacea. Enrichment factors varied according to metal and species. The Zn concentration factor was 2,200; and Pb, 2,400. Metal samples were collected in the Leine River, upstream and downstream from the city of Goettingen, West Germany. Cd, Cu, Ni, Zn, and Hg levels were higher downstream (0.34, 7.5, 3.8, 11.5, and 0.11 ppb respectively) from the sewage outlets, but were below WHO maximum allowable concentrations for drinking water. (Cassar-FRC)
W81-02252

USE OF AN OXIDATIVE DESTRUCTION AND QUADRUPOLE MASS SPECTROMETRIC (QMS) DETECTION FOR THE DETERMINATION OF THE ORGANIC ELEMENTAL COMPOSITION OF SUSPENDED MATTER IN SURFACE WATER,
Rijksinstituut voor de Volksgezondheid, Bilthoven (Netherlands).
H. F. R. Reijnders, D. Onderdelinden, M. G. Visser, and B. Griepink.
Water Research, Vol 14, No 11, p 1645-1650, November, 1980. 6 Fig, 3 Tab, 6 Ref.

Descriptors: *Water analysis, *Mass spectrometry, *Organic matter, Separation techniques, Centrifugation, Carbohydrates, Surface waters, Water pollution, Pollutant identification, Proteins, Suspended solids, Chlorine, Carbon, Hydrogen, Sulfur, Nitrogen.

Elemental analysis of suspended organic matter in surface waters is becoming extremely important in the study of water pollution and the characterization of water types. A method involving oxidative destruction and quadrupole mass spectrometry was applied to the characterization and elemental analysis of suspended particulate of water samples from 12 different locations. The same sites included a brook, two waste water treatment plants, a ditch, four rivers, four canals and one canalized river, all located in the Netherlands. Solid matter was separated from the samples by centrifugation, concentration and drying. Spectrophotometric analyses for H, C, N, S and Cl were carried out, and the ratio of the organic to the inorganic fraction was determined. Results obtained by conventional methods and by the present technique on the elemental composition of a waste water treatment plant sludge were compared. A linear relationship was found only for the hydrogen vs. carbon content; however, the new method only required about 30 minutes for sample preparation and analysis. Further studies are recommended to determine more accurately the variance in the results from different origins. (Geiger-FRC)
W81-02254

COMPARISON OF SPECTROFLUOROMETRY AND ION-SELECTIVE ELECTRODE POTENTIOMETRY FOR DETERMINATION OF COMPLEXES BETWEEN FULVIC ACID AND HEAVY-METAL IONS,
New Hampshire Univ., Durham. Dept. of Chemistry.
R. A. Saar, and J. H. Weber.
Analytical Chemistry, Vol 52, No 13, p 2095-2100, November, 1980. 6 Fig, 1 Tab, 27 Ref

Descriptors: *Fulvic acids, *Metals, *Complexation, Pollutant identification, Fluorescence, Analytical techniques, Copper, Organic acids, Potentiometers, Fluorometry, Heavy metals, Lead, Ions, Chemical reactions.

Fluorescence properties of two fulvic acids, one soil-derived (SFA) and one water-derived (WFA), were examined. Maximum emission intensity occurred at 445-450 nm with excitation at 350 nm. This peak was unaffected by oxygen or electrolyte, KNO3, concentration. Emission intensity reached a maximum at pH 5 for SAF and about 3.5 for WFA, dropping off rapidly at lower pH. The paramagnetic ion Cu(2+) was most effective in quenching fluorescence. At pH 2.1 and below almost no quenching occurred, and it increased to a maximum about pH 6. Very similar cures were produced by the two methods, fluorometry and ion-selective electrode potentiometry, when mole ratio of total Cu(2+) to total SFA was plotted against % of original, metal-free fluorescence remaining at specified pH (fluorometry) and Cu(2+)/SFA versus number of bound Cu(2+) ions per fulvic acid molecule (potentiometry). Experiments at pH 1.4-1.5, where little metal-complexing occurs, showed that Cu(2+) and Pb(2+) produced a very small amount of quenching (3.5 and 3.8%) even with high metal ion concentrations. Ni(2+), Mn(2+), Co(2+), and Cd(2+) caused even less quenching. Pb(2+), a diamagnetic ion, was not as effective a quenching agent as Cu(2+). (Cassar-FRC)
W81-02260

TECHNIQUES FOR VIRUS DETECTION IN THE MARINE ENVIRONMENT,
Florida Water Resources Research Center, Gainesville.
G. Bitton, S. R. Farrah, E. M. Hoffmann, B. N. Feldberg, and Y. J. Chou
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182149, Price codes: A04 in paper copy, A01 in microfiche. Publication No 53, 1981. 42 p, 1 Fig, 18 Tab, 49 Ref OWRT-A-036-FLA(1), 14-34-0001-0110

Descriptors: *Viruses, Detection techniques, *Seawater, *Sediments, Adsorption, Filters, *Pollutant identification.

This study dealt with the development of methodology for virus recovery from the marine environment. We have explored a variety of methods for the recovery of enteroviruses from seawater which has been inoculatd with high liters of poliovirus 1, 2, and 3, coxsackie B3 and echovirus 1 and 4. We have developed a technique based on the adsorption of viruses to Filterite filters, elution with 1% non-fat dry milk (NFDM), and organic flocculation of the eluates. This method resulted in the efficient recovery of most enteroviruses tested except for echovirus type 1. The method was also suitable for virus recovery from tap water. Various eluents were tested for their ability to desorb viruses from marine sediments. In laboratory experiments 4M urea-0.05M lysine was the most efficient in virus recovery from sediment. Although the method is time consuming, it results in a small volume of concentrate. The methods developed in the course of this study were used to recover indigenous viruses from estuarine water and sediments. Enteroviruses were found in both water and sediment in a section of Matanzas River which was closed with regard to shellfish harvesting.
W81-02274

QUANTIFICATION OF NUTRIENT LOADINGS TO THE CHESAPEAKE BAY: A STRATEGY,
Environmental Protection Agency, Annapolis, MD. Chesapeake Bay Program.
T. H. Pheiffer, J. T. Smullen, and C. J. Klein.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 39-45, 1981. 2 Fig, 13 Ref.

Descriptors: *Chesapeake Bay, *Nutrients, *Nutrient loads, *Predictive modeling, Simulation analysis, *Model studies, Eutrophication, Monitoring, Land use, Data collections, Water quality, Mathematical models, Computer models, Remote sensing, *Nonpoint pollution sources.

A major objective of the Environmental Protection Agency's (EPA) Chesapeake Bay Program Eutrophication Work Plan is the quantification of nutrient loadings to the Bay from various sources. Data are being gathered from many sources to be used in a predictive model. Point source information from municipal and industrial sources is being synthesized from existing EPA and State and agency files. LANDSAT data will be used to perform land-use analyses to develop nonpoint source runoff projections. Fall line monitoring on the Susquehanna, Potomac, and James Rivers will provide data on suspended sediments, nutrients, metals, pesticides, fresh water discharge, and other physical and chemical parameters. Nonpoint monitoring programs are being conducted in the Occoquan and Ware River watersheds and in the Pequea Creek basin. The Hydrologic Simulation Program in Fortran has been selected for modeling of the non-tidal drainage basin of the Bay. Following verification of the model, it will be used to produce time series output of current and future loadings, land-use patterns, and input for a Bay-wide water quality model at the tidal Chesapeake. (See also W81-02276) (Seigler-IPA)
W81-02284

EVALUATION OF NONPOINT SOURCE SAMPLING, LOADING RATES, AND DATA TRANSFERABILITY FOR AN ESTUARINE DRAINAGE BASIN OF CHESAPEAKE BAY,
Tidewater Administration, Annapolis, MD
C. Bostater, B. Walker, and J. Weaver
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 64-73, 1981. 12 Fig.

Descriptors: *Chesapeake Bay, *Northeast Creek, Water sampling, *Phosphorus, Water quality, Rainfall-runoff relationships, Suspended load, Suspended solids, Nitrates, Nitrites, Nitrogen, Dissolved oxygen, Biochemical oxygen demand, *Nonpoint pollution sources, *Estuaries.

Monitoring of water quality parameters at the Northeast Creek USGS Gaging Station revealed that a high percentage of the total annual phosphorus load occurs during only a few days of the year due to rainfall events. Northeast Creek is the major freshwater input into the Northeast River, a subestuary of the Chesapeake Bay. The drainage area of 24.3 sq miles is approximately 40% agricultural, 50% forested, and 10% other. Water quality parameters measured include total Kjeldahl nitrogen, nitrite, nitrate, ortho-phosphorus, total phosphorus, dissolved oxygen, biochemical oxygen demand, suspended solids, total solids, and suspended volatile solids. Samples were collected using a proportional sampling technique with an ISCO automatic sampler and an ISCO pressure transducer flow meter. Results show a total phosphorus runoff coefficient of 1.54 lb/day/sq mi for a total for the watershed of 18.6 tons/year. A random sampling of flow-weighted mean total phosphorus concentrations shows that baseflow yield is important for annual nutrient export estimates. (See also W81-02276) (Seigler-IPA)
W81-02287

A FIELD-SCALE MODEL FOR NONPOINT SOURCE POLLUTION EVALUATION,
Science and Education Administration, Tucson., AZ. Southwest Watershed Center
W. G. Knisel
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 100-106, 1981. 15 Ref

Descriptors: *Nonpoint pollution sources, *Agricultural runoff, *Computer models, Mathematical models, Estimating, Erosion rates, Evapotranspiration, Pesticides, Sedimentation, Best management practices, Percolation, Particle size, Sediment load, Water pollution sources.

A field-scale simulation model, CREAMS, was developed to evaluate nonpoint source pollution from agricultural fields. The model does not require calibration and it can simulate processes in hydrology, erosion, plant nutrient losses, and pesticide losses as affected by management practices. CREAMS has three major components: hydrology, erosion/sedimentation, and chemistry. Runoff volume and peak rates, evapotranspiration, soil water content, and percolation are estimated on a daily basis by the hydrology component. The erosion component estimates erosion and sediment yield along with particle size distribution. Storm loads and chemical concentrations are estimated for runoff, sediment, and percolation fractions. Extensive model testing includes: for the hydrology component, 30 watersheds in 13 land resource areas; for the erosion component, 5 land resource areas; and for the chemistry component, 3 land resource areas. The computer program is efficient, costing only a few dollars for a year of calculations. (See also W81-02276) (Seigler-IPA)
W81-02290

OXYGEN-RICH GAS DOMES OF MICROBIAL ORIGIN IN THE SALT CRUST OF THE GREAT SALT LAKE, UTAH,
Utah Water Research Lab., Logan.
F. J. Post.
Geomicrobiology Journal, Vol 2, No 2, p 127-139, 1980. 4 Fig, 1 Tab, 13 Ref. OWRT-A-024-UTAH(7), 14-34-0001-6046.

Descriptors: Terminal lake, Halophilic, Nitrogen cycling, Protozoa, Drought, *Evaporation, *Chemical precipitation, *Sodium chloride, *Microbiology, Oxygen, *Great Salt Lake, Utah, *Gas domes, Dunaliella salina, D. viridis.

During the summer of 1977, a severe drought throughout the western part of the United States caused the north arm of the Great Salt Lake, Utah, to evaporate to its lowest level in a number of years, resulting in the precipitation of about 99.6% pure sodium chloride. At the extreme north end of the north arm, in the vicinity of Monument Point, low humidity combined with a shallow-bottom gradient to form a salt crust along the lake margin in which gas-emitting domes were common. The domes varied in size; each contained a large amount of gas that analysis showed to be 82 to 86% oxygen and 14 to 18% nitrogen, with <0.2% or no methane, and no detectable carbon dioxide. The bottom of the crust of the domes (3 to 4 cm thick) was a bright red color. Microscopic examination of this red zone revealed 3.5 x 10 sup 4 cells of Dunaliella salina, 2 x 10 sup 3 cells of D. viridis and 10 sup 8 to 10 sup 9 clumps of red halophilic bacteria per g of salt. Measurements in situ showed sufficient light (34 klx) and temperature (34C) under the salt to favor the growth of the algae and associated bacteria within the water phase of the crust or in water immediately underneath the crust. Oxygen produced as a result of algal photosynthesis was trapped under the crust until the crust was either eroded by waves or broken under pressure, releasing the gas. The domes were not observed during the summers of 1978 and 1979.
W81-02310

AVAILABILITY AND PLANT UPTAKE OF HEAVY METALS FROM CONTAMINATED DREDGED MATERIAL PLACED IN FLOODED AND UPLAND DISPOSAL ENVIRONMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
C. R. Lee, B. L. Folsom, Jr., and R. M. Engler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173825, Price codes: A13 in paper copy, A01 in microfiche. In: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the Fifth United States-Japan Experts Meeting, Nov. 1979, New Orleans, LA. Environmental Protection Agency Rpt. EPA-600/9-80-044, Sep. 1980. p45-59. 4 Fig, 6 Tab, 17 Ref.

Descriptors: *Heavy metals, *Bioassay, *Phytotoxicity, *Soil contamination, *Dredging, Waste disposal, Cadmium, Zinc, Arsenic, Bioaccumulation, Waste treatment, Channel improvement, *Sediments, Sampling, Testing procedures.

A solid-phase plant bioassay was used in an attempt to verify previous dredged material results and to develop a procedure that could indicate phytotoxicity and bioaccumulation of heavy metals in contaminated dredged material. Sediments known to be highly contaminated with one or more contaminants were collected from five freshwater locations in the Great Lakes and five saltwater locations in the U. S. The plant species used as indicators were Cyperus esculentus in the freshwater sediment tests and Spartina alterniflora and Distichlis spicata in the saltwater sediment tests. The bioassays indicated that greater uptake of cadmium and zinc occurred from dredged freshwater sediments in the upland disposal environment than from the flooded environment. The reverse was true for arsenic, with an increase in bioaccumulation and phytotoxicity observed in the flooded environment. Factors influencing the availability and plant uptake of the heavy metals include sediment redox potential, organic matter content, total sulfur content, and pH. (Brambley-SRC)
W81-02316

DISSOLVED OXYGEN AND TEMPERATURE SURVEY OF THE LOWER SUSQUEHANNA RIVER, AUGUST 9TH AND 10TH, 1979,
Susquehanna River Basin Commission, Harrisburg, PA.
S. E. Rudisill, and G. E. Senko.
Publication No 70, September, 1980. 71 p, 28 Fig, 6 Tab, 2 Append.

Descriptors: *Pennsylvania, *Dissolved oxygen, *Water temperature, *Rivers, *Dams, *Hydroelectric power, Reservoirs, Data collection, Water storage, Water quality, New York, Maryland, River basin commissions, Interstate commissions, River flow, *Susquehana River.

To evaluate and document the impact of three hydroelectric facilities--Conowingo, Holtwood, and Safe Harbor---on the Lower Susquehanna River, dissolved oxygen (DO) concentration and water temperature measurements were collected on August 9th and 10th, 1979, by the Susquehanna River Basin Commission in cooperation with state and federal agencies. The study area encompassed the lower forty miles of the Susquehanna River from Columbia, PA, to its mouth. A total of 31 transects were established between Columbia, PA, and the mouth of Susquehanna River at Havre De Grace, MD. Measurements were made at a minimum of three sites across each transect and at various depths at each site. In addition, measurements were made off both the upstream and downstream faces of Conowingo. The Maryland Department of Natural Resources provided data from their continuous recorder of DO and temperature on Bird Island at river mile 8.8 below Conowingo. No impacts on water temperature were observed; however, the investigator found that the three hydroelectric facilities and their associated reservoirs have created conditions that cause a significant decrease in DO concentrations from those found in the free-flowing river upstream of the impoundments. The lowest DO concentrations were found during periods of shutdown, but water quality standards cannot be maintained even during full generation below Conowingo. The most severe impacts on DO concentrations are found below Safe Harbor and Conowingo Dams, and the river begins to recover in the tidal areas below Deer Creek. A DO gradient occurs in front of all three dams; it is particularly severe in front of Conowingo. (Garrison-Omniplan)
W81-02338

LIMNOLOGICAL DATA FOR 12 RESERVOIRS IN VALLEY COUNTY, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2H.
W81-02351

ESTIMATION OF BACKGROUND LOADINGS AND CONCENTRATIONS OF PHOSPHORUS FOR LAKES IN THE PUGET SOUND REGION, WASHINGTON,
Geological Survey, Seattle, WA. Water Resources Div.
R. J. Gilliom.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $5.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-328, March, 1980. 37 p, 6 Fig, 2 Tab, 28 Ref.

Descriptors: *Estimating, *Phosphorus, *Lakes, *Washington, Model studies, Regression analysis, Eutrophication, Nutrients, Water quality, Land use, Puget Sound region(WA), Pacific Northwest.

For lakes in watersheds that include developed land, evaluation of eutrophication is facilitated by knowledge of changes in the lakes' phosphorus concentration since development. A method is described for estimating background phosphorus concentration in lakes of the Puget Sound lowland, Washington. Using a mass-balance 'Vollenweider-type' model, phosphorus loadings were calculated from present-day phosphorus concentrations measured in lake water and from easily measured physical characteristics for 24 lakes in undeveloped, or insignificantly developed, watersheds. Phosphorus loading from forest (undeveloped) land was derived for each lake as the difference between the calculated phosphorus loading directly to the lake's surface and loading by bulk precipitation (estimated from other studies). Forest-land loading to each lake was converted to the yield (mass per unit area) of the forested part of the watershed. The phosphorus yield from forest land was related to annual runoff, and the regression equation expressing this relationship explained 73% of the sample variance. By applying that regression equation to the appropriate annual-runoff data, the yield of phosphorus from forest land can be estimated for any lake in the study area. Phosphorus loading from forested land then can be added to direct loading by bulk precipitation to estimate background phosphorus loading for each lake. By applying the mass-balance model to calculated background loadings, background total-phosphorus concentration can also be calculated for all lakes in the study area that have stable thermal stratification during the summer. The standard error of estimate for calculated background loadings and concentrations averages about 25%. (USGS)
W81-02383

DISCHARGE DATA AT WATER-QUALITY MONITORING STATIONS IN ARKANSAS, 1979 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 2E.
W81-02386

5B. Sources Of Pollution

DEGRADATION OF THE HERBICIDE 2,4-D IN RIVER WATER - I. DESCRIPTION OF STUDY AREA AND SURVEY OF RATE DETERMING FACTORS,
Western Australia Univ., Nedlands. Dept. of Soil Science and Plant Nutrition.
H. J. Nesbitt, and J. R. Watson.
Water Research, Vol 14, No 12, p 1683-1688, December, 1980. 2 Fig, 2 Tab, 21 Ref.

Descriptors: *2,4-D, *Microbial degradation, *Nutrients, Phosphorus, Nitrogen, Biodegradation, *Australia, Spectrophotometry, Rivers, Sediment distribution, Temperature, Aquatic microorganisms, *Herbicides, Aquatic bacteria, Avon River.

Water samples taken from the Avon River at Walyunga National Park, Australia, were analyzed for their ability to degrade 2,4-D, a herbicide used extensively for noxious weed control along river banks and in agriculture in this country. Nutrient information and other water parameters were recorded, and measured amounts of river water sam-

ples were poured into sterilized bottles containing 1000 ppm 2,4-D sodium salt solutions. The bottles were capped and incubated at 25 degrees in the dark, and samples were drawn at periodic intervals and analyzed for 2,4-D levels by a Varian 635D Spectrophotometer. Results showed that 2,4-D biodegradation was dependent on the river water bacterial activity rather than on the total number or species of organisms present. The microbial activity was related primarily to the nutrient level of the river water and the distribution of the sediments. Concentrations of phosphorus and nitrogen, the two main nutrients, were so low that their effect on biodegradation was uncertain. More research on the effects of temperature and nutrient levels on the biodegradation of 2,4-D was recommended. (Geiger-FRC)
W81-02152

DEGRADATION OF THE HERBICIDE 2,4-D IN RIVER WATER - II. THE ROLE OF SUSPENDED SEDIMENT, NUTRIENTS AND WATER TEMPERATURE,
Western Australia Univ., Nedlands. Dept. of Soil Science and Plant Nutrition.
H. J. Nesbitt, and J. R. Watson.
Water Research, Vol 14, No 12, p 1689-1694, December, 1980. 5 Fig, 1 Tab, 9 Ref.

Descriptors: *2,4-D, *Microbial degradation, *Nutrients, *Temperature, Biodegradation, Phosphorus, Seasonal, Rivers, Australia, *Herbicides, Nitrogen, Sediment load, Carbon, Aquatic bacteria, Path of pollutants.

Previous studies on the biodegradation of 2,4-D in the Avon River, Australia, have shown that the rate of the degradation is influenced by the nutrient level of the river water, the dissolved organic carbon content, and the sediment load. Phosphorus levels were correlated with sediment load, but no relationship was found between sediment load and nitrogen levels nor between bacterial numbers, sediment load and 2,4-D half life. The effects of each of these factors and of temperature on the proliferation of 2,4-D metabolizing microorganisms were examined. When sediments and inorganic nutrients were added to river water samples spiked with 2,4-D, the rate of degradation of the herbicide increased. Additions of microorganisms involved in the degradation process did not significantly enhance the breakdown of 2,4-D, suggesting that the 2,4-D degradation rate was independent of the availability of organisms capable of degrading the herbicide. During the winter months in Australia, the river temperature may fall below 11 degrees, which is well below the optimum for bacterial activity. It was speculated that influxes of 2,4-D into the river during this season would probably be carried, with little degradation, into the river estuary. (Geiger-FRC)
W81-02153

DEGRADATION OF CHLOROPHENOLS IN SOIL, SEDIMENT, AND WATER AT LOW TEMPERATURE,
Waterloo Univ., (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W81-02193

A REACTOR NETWORK MODEL OF THE PASSAIC RIVER,
Rutgers - The State Univ., New Brunswick, NJ.
R. C. Ahlert, and S-F. Hsueh.
Ecological Modelling, Vol 10, p 47-61, June, 1980. 7 Fig, 4 Tab, 9 Ref.

Descriptors: *Mathematical models, *Dispersion, *Rivers, Tracers, *Path of pollutants, Networks, Statistical models, Water quality, New Jersey, Tracking techniques, *Passaic River.

A modelling concept based on a network of ideal reactor elements is illustrated with tracer data for the Passaic River (New Jersey). During model construction, two ideal reactors were considered which were extreme types in terms of mixing and dispersion phenomena. The plug-flow tubular reactor was a pure time delay with dispersion completely absent. The continuous stirred tank reactor was an instantaneously mixed system with dispersion at a maximum. Trail network configurations were evaluated using Parseval's theorem and applying a least-squares procedure. Time-of-travel measurements were performed independently on consecutive tidal segments of the Passaic River from Little Falls to the Outwater Lane Bridge. Four possible models were evaluated using the data. The resulting network model has applications to water quality management if mixing is important and leads to residence-time distributions varying from the mean or nominal time-of-travel. (Small-FRC)
W81-02195

CONCENTRATIONS OF PU-239,240, CS-137, AND SR-90 IN THE WATERS OF THE LAURENTIAN GREAT LAKES, COMPARISON OF 1973 AND 1976 VALUES,
Savannah River Ecology Lab., Aiken, SC.
J. J. Alberts, and M. A. Wahlgren.
Environmental Science and Technology, Vol 15, No 1, p 94-98, January, 1981. 7 Tab, 11 Ref.

Descriptors: *Great Lakes, *Radioisotopes, Strontium, Plutonium, Cesium, *Fallout, *Water pollution, Pollutant identification, Lakes, Lake Erie, Lake Huron, Lake Ontario, Lake Michigan.

Concentrations of plutonium-239,240, cesium-137, and strontium-90 were measured in four of the Great Lakes in 1973 and 1976. Sr-90 concentration (0.82-1.28 pCi per liter) remained constant in all lakes. Pu-239,240 concentrations for Lake Michigan were (in fCi per liter) 0.69 in 1973 and 0.49 in 1976; Cs-137 was 40 in 1973 and 56 in 1976. Lake Huron concentrations were Pu-239,240, 0.93 to 0.98 in 1973 and 0.88 to 1.03 in 1976; Cs-137, 39-44 in 1973 and 31.3 to 37.6 in 1976. Lake Erie levels of Pu-239,240 were 0.16 to 0.24 in 1973 and 0.11 to 0.19 in 1976; Cs-237, 15 to 22.5 in 1973 and 10.4 to 26.3 in 1976. Lake Ontario levels were Pu-239,240, 0.24 in 1973 and 0.04 to 0.35 in 1976; Cs-137, 26 to 29 in 1973 and 25.1 to 36.4 in 1976. Studies of the submicrometer particle size and charge characteristics of Pu-239,240 showed that it is a simple anionic complex or is associated with particles smaller than 30 Angstroms and negatively charged. (Cassar-FRC)
W81-02198

KINETIC STUDY OF THE BIODEGRADATION OF BIPHENYL AND ITS MONOCHLORINATED ANALOGUES BY A MIXED MARINE MICROBIAL COMMUNITY,
Alaska Univ., Fairbanks. Inst. of Marine Science.
P. B. Reichardt, B. L. Chadwick, M. A. Cole, B. R. Robertson, and D. K. Button.
Environmental Science and Technology, Vol 15, No 1, p 75-79, January, 1981. 1 Fig, 6 Tab, 24 Ref.

Descriptors: *Biodegradation, *Organic compounds, *Microbial degradation, *Coastal waters, Biphenyl, Estuaries, Sea water, Path of pollutants, Water pollution, *Alaska, Chlorinated biphenyls.

Biphenyl was more rapidly biodegraded by a microbial community from Alaskan coastal waters than were its monochloro derivatives. Relative maximal rates expressed on a molar basis were: biphenyl 1.0, 2-chlorobiphenyl 0.40, 3-chlorobiphenyl 0.27, and 4-chlorobiphenyl 0.33. The rate of biodegradation for biphenyl was 9.3 to 9.8 nmol per liter per day. Biphenyl and its compounds did not form significant amounts of intermediates, but degraded completely to CO2. Turnover time for monochlorobiphenyls in an Alaskan esturay was estimated to be 1 year at a level of 0.1 micrograms per liter. (Cassar-FRC)
W81-02199

BEHAVIOR OF RADIUM AND BARIUM IN A SYSTEM INCLUDING URANIUM MINE WASTE WATERS AND ADJACENT SURFACE WATERS,
Technical Univ. of Prague (Czechoslovakia). Dept. of Nuclear Chemistry.
R. Sebesta, P. Benes, J. Sedlacek, J. John, and R. Sandrik.
Environmental Science and Technology, Vol 15, No 1, p 71-75, January, 1981. 1 Fig, 3 Tab, 16 Ref.

Descriptors: *Uranium, Radium, Barium sulfate, *Sedimentation, Mine water, Chemical precipitation, Surface waters, *Waste water treatment, *Mine wastes, Water pollution, Path of pollutants, Industrial wastes, Chemical reactions, Suspended solids, Ion exchange, Cation exchange.

Investigation of uranium mine waste water purification in a typical system showed that ion exchangers removed an average of 87% of the radium but functioned variably. Subsequent barium sulfate precipitation was insufficient--76% average efficiency. Waste water was sampled at 8 locations in the process stream, from ion exchange influent to upstream and downstream from the outfall. Ra concentration (in picograms per liter) was highest before sedimentation (but after ion exchange): 331-2181 dissolved and 65-2729 particulate. Values before and after ion exchange were 265-380 dissolved and 1.6-7.5 particulate and 14-59 dissolved, 0.6-11.0 particulate respectively. Ra levels in water samples from the outlet of the sedimentation pond and in various places downstream were in the range 2.9-19 dissolved and 6.9-227 particulate. The main factors influencing levels and forms of Ra and Ba in surface waters were dilution with river water and sedimentation of particulates in the river. Ra and Ba behaved similarly throughout the system. The predominant particulate form in the water was Ba(Ra)S04. (Cassar-FRC)
W81-02200

TRACE ORGANICS IN GROUNDWATER,
Stanford Univ., CA. Dept. of Civil Engineering.
P. L. McCarty, M. Reinhard, and B. E. Rittmann.
Environmental Science and Technology, Vol 15, No 1, p 40-48, 51, January, 1981. 9 Fig, 4 Tab, 16 Ref.

Descriptors: *Organic compounds, *Groundwater, *Path of pollutants, Biodegradation, Sorption, Water pollution, Aquifers, Bacteria.

The movement and fate of trace organic compounds in groundwater are governed largely by sorption and biodegradation. Sorption can affect the rate of travel of the contaminants with respect to that of water and allow accumulation on subsurface solid media. The octanol/water partition coefficient is a useful value to predict relative retention times. Predicted and measured values for chloroform, chlorobenzene, and 1,4-dichlorobenzene agreed well. Further research is needed on the interaction of organic matter with inorganic surfaces and on the interaction of the many different aquifer components. Biofilm models are useful to predict biodegradability. The minimum concentration at which a single organic material may be biodegraded under steady-state conditions depends on growth and decay coefficients of the bacteria, which are in turn dependent on temperature, pH, species, and available electron acceptors. Relatively little is known about the kinetics of degradation of mixed substances at low concentrations and the nature of the intermediate substances formed. (Cassar-FRC)
W81-02201

AIRBORNE ORGANIC CONTAMINANTS IN THE GREAT LAKES ECOSYSTEM,
Minnesota Univ., Minneapolis
S. J. Eisenreich, B. B. Looney, and J. D. Thornton.
Environmental Science and Technology, Vol 15, No 1, p 30-38, January, 1981. 2 Fig, 10 Tab, 42 Ref.

Descriptors: *Water pollution sources, *Air pollution effects, *Great Lakes, Polychlorinated biphenyls, *Organic compounds, Pesticides, Path of pollutants, Precipitation, Food chains, Lakes, Surface waters, Polynuclear aromatic hydrocarbons, Industrial wastes.

Pollution of the Great Lakes by airborne organic contaminants is significant and leads to accumulation in the food chains because, with the exception of Lake Erie, concentrations of suspended solids

available for pollutant removal are less than 1 mg per liter. In addition, major pollution sources are upwind, surface areas and surface area to basin ratio are large, water and chemical residence times are long, and redistribution occurs through mixing. Trace organics in the air may enter the water by adsorption onto particulate matter, partitioning across the air-water interface, wet deposition through rain and snow, and dry deposition by aerosols. A table lists total annual deposition of airborne trace organics to each of the 5 Great Lakes for polychlorinated biphenyls (PCB), several pesticides, and several polynuclear aromatic hydrocarbons. The chemical with most information available is PCB. Total sources in Lake Superior are estimated at 8,000-9,700 kg per year, with 6,600-8,300 of this coming from the atmosphere. Sinks are 1,100-1,700 kg per year, leaving an annual addition of 6,300-8,000 per year. Water concentration is increasing at the rate of 0.1-0.5 ng per liter per year. Although PCB production was prohibited in 1979 and their disposal was regulated, PCBs are widespread in the environment and are capable of codistillation, volatilization from landfills and incomplete incineration. (Cassar-FRC)
W81-02202

TETRACHLOROETHYLENE CONTAMINATION OF DRINKING WATER BY VINYL-COATED ASBESTOS-CEMENT PIPE,
Woods Hole Oceanographic Insitution, MA.
S. G. Wakeham, A. C. Davis, R. T. Witt, B. W. Tripp, and N. M. Frew.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 4, p 639-645, October, 1980. 1 Fig, 2 Tab, 17 Ref.

Descriptors: *Potable water, *Pipes, Vinyl, Asbestos cement, Analytical techniques, Public health, *Water pollution, Sampling, Organic compounds, Water quality, Water purification, *Tetrachloroethylene, Plastics, Coatings.

A preliminary study to assess tetrachloroethylene contamination of drinking waters flowing in vinyl-coated asbestos-cement pipes was conducted in Falmouth, Massachusetts. Tetrachloroethylene is used as the solvent during application of the vinyl coating to the piping in order to prevent asbestos fibers from entering the water. Data was obtained from a survey of the town's water distribution system in a pipe flushing and recovery experiment. Levels of tetrachloroethylene ranged from 140 to 18,000 ppb in unflushed pipes, yet were less than 2 ppb in other parts of the town's system. As long as tetrachloroethylene contamination was occurring, no amount of flushing reduced contamination downstream. Measurements at one sampling area suggest that tetrachloroethylene may continue to leach out of pipes for 5 to 8 years after installation. (Titus-FRC)
W81-02233

RELATIONSHIPS BETWEEN FORMS OF NITROGEN AND HYDROLOGICAL CHARACTERISTICS IN A SMALL STREAM NEAR ADELAIDE, SOUTH AUSTRALIA,
Adelaide Univ. (Australia). Centre for Environmental Studies.
A. N. Holmes, W. D. Williams, and G. Wood.
Australian Journal of Marine and Freshwater Research, Vol 31, No 3, p 297-317, June, 1980. 10 Fig, 8 Tab, 38 Ref.

Descriptors: *Nitrogen compounds, *Streamflow, *Base flow, Storm runoff, Nutrients, Adelaide, *Australia, Nitrates, Flow, Discharge(Water), Agriculture, Variability, Regression analysis, Water pollution sources.

Concentrations of nitrogen compounds in various forms were related to flow characteristics of a small stream draining an agricultural area near Adelaide, South Australia. During baseflow, nitrate-nitrogen was predominant, 4.34 mg per liter. Ammonium-nitrogen was 0.06; filtered total Kjeldahl nitrogen (TKN), 0.23; TKN, 0.62; and total nitrogen, 4.97 (all values are in mg per liter). Stormflow showed TKN dominant, 8.20; filtered TKN, 1.14; nitrate-nitrogen, 3.81; ammonium-nitrogen, 0.49; and total nitrogen, 11.85. No relationship existed between concentrations of nitrate-nitrogen and discharge in the baseflow range. For the TKN fraction there was a relationship between concentration-discharge and load-discharge plots, but four abnormally high values affected the correlations. An annual total nitrogen load of 9.9 tons or 24.2 kg per hectare per year (1976-77) was calculated. Reduced nitrogen (measured as TKN) and nitrate-nitrogen were 7.8 and 16.4 kg per hectare per year respectively. (Cassar-FRC)
W81-02234

HYDROCHEMICAL CHARACTERISTICS AND POLLUTION OF THE RIVER BIALA PRZEMSZA CATCHMENT BASIN,
Jagellonian Univ., Krakow (Poland). Dept. of Hydrobiology.
K. Jop.
Acta Hydrobiologica, Vol 22, No 2, p 179-190, 1980. 1 Fig, 2 Tab, 22 Ref.

Descriptors: *Heavy metals, *Watersheds(Basins), *Biala Przemsza River, *Water pollution effects, *Industrial wastes, Path of pollutants, Bottom sediments, Water quality, *Poland, Zinc, Iron, Copper, Lead, Cadmium, Nickel, Domestic wastes, Basins, Wastes, Metals, Sodium, Sulfates, Chlorides, Organic wastes, Self-purification, Pulp wastes.

Contaminants and the basic chemical composition of water and sediments in the River Biala Przemsza, Poland, basin were determined at 16 stations 9 times throughout 1977. Municipal and industrial wastes are discharged into various tributaries. In polluted sections of the river, carbonates were lower and sulfates, chlorides, and sodium higher. The municipal wastes added great quantities of nitrogen and phosphorus compounds and produced increases in BOD downstream from the sewer outfalls. Downstream, the self-purification process caused gradual increases in oxygenation and decreases in organic matter and all elements investigated. Heavy metals precipitated from the water, chiefly with ferric hydroxides. However, ammonia, organic nitrogen and total phosphorus remained high, and sediments contained increased amounts of heavy metals. Three types of water were seen in the catchment basin. The most pure water contained (in ppb) Cd, 0; Pb, 0-30; Cu, 0-51; Ni, 0-15; Zn, 93-330; and Fe, 105-215. Bottom sediments contained (in ppm) Cd, 0-3; Pb, 20-263, Cu, 16-55; Ni, 16-44; and Zn, 9-93. Water in the more contaminated area contained 3 to 5 times these levels of metals, and sediments, 4 to 6 times, with the exception of Zn, 16 times. Water in the most contaminated area contained (in ppb) Cd, 0-5; Pb, 25-78; Cu, 5-35; Ni, 6-18; Zn, 340-1572; Fe, 107-3095. Bottom sediment contained (in ppm) Cd, 0-89; Pb, 93-3367; Cu, 25-931; Ni, 2-152; and Zn, 123-1448. Since the time when similar determinations had been performed, in 1971-1972, the mean concentration of metals has doubled. (Cassar-FRC)
W81-02245

THE MANAGEMENT OF THE CATCHMENT AREA OF THE GOCZALKOWICE RESERVOIR AND ITS EFFECT ON THE AMOUNT OF NITROGEN AND PHOSPHORUS MIGRATION FROM IT,
Polish Academy of Sciences, Pszcyna. Lab. of Water Biology.
H. Kasza.
Acta Hydrobiologica, Vol 22, No 1, p 37-53, 1980. 4 Fig, 3 Tab, 31 Ref.

Descriptors: *Runoff, *Phosphorus compounds, *Nitrogen compounds, *Reservoirs, *Watersheds(Basins), Goczalkowice reservoir, Regression analysis, Phosphates, Sewage, Water pollution sources, Municipal wastes, Fertilizers, Nutrients, *Poland.

Calculations of the runoff per unit of nitrogen and phosphorus in waters of the Goczalkowice Reservoir catchment area, Poland, showed the degree of anthropogenic influence. The nutrient levels in annual mean runoff in the 3 rivers investigated were: inorganic nitrogen, 1.173 grams per cu meter per year, Vistula; 0.484, Bajerka River; and 0.182, Knajka River. These are within the limits adopted for oligotrophic catchment areas. Total phosphorus levels averaged 0.028 grams per cubic meter, and phosphates, 0.011 grams per cubic meter for each river. General observations were that woodlands, particularly oak and birch, contributed a greater amount of inorganic nitrogen than farm lands and green areas. No correlation was evident between intensity of fertilizer use and concentration of inorganic nitrogen in runoff waters. Phosphorus seemed to be absorbed while rivers flowed over wooded terrain, whereas farm areas contributed phosphorus to the total runoff. Sewage was responsible for 55-58% of the phosphorus entering the reservoir; the remainder came from eroded soil and groundwaters. (Cassar-FRC)
W81-02246

HETEROTROPHIC MICROFLORA OF THE RESERVOIR AT LUBACHOW. 2. VERTICAL DISTRIBUTION OF BACTERIA PREDOMINATING IN THE RESERVOIR AT LUBACHOW IN THE ANNUAL CYCLE,
Instytut Inzynierii Ochrony Srodowiska Politechniki Slaskiej, Gliwice (Poland).
M. Pawlaczyk-Szpilowa, H. Sztajer, and D. Leszczynska.
Acta Hydrobiologica, Vol 22, No 1, p 13-27, 1980. 2 Fig, 5 Tab, 14 Ref.

Descriptors: *Bacteria, *Lubachow, *Reservoirs, *Municipal wastes, Sewage, Microorganisms, Aquatic bacteria, Water pollution effects, *Poland, Biological oxygen demand, Pollutants, Path of pollutants, Bacillus, E. coli, Pseudomonas.

Heterotrophic bacteria, numerous in polluted waters, were studied in a vertical water column 28 meters deep in a reservoir at Lubachow, Poland, with respect to thermal and chemical characteristics of the water from May 1973 to January 1974. The most prevalent bacterium was Bacillus, a genus able to utilize a wide variety of organic substrates and resist toxins and oxygen deficit. In winter, conditions at the bottom were less toxic and more oxygenated, and Pseudomonas prevailed. In spite of the constant flow of domestic sewage to the reservoir, Escherichia were not present. The lowest BOD5 values were observed at the bottom, where the heaviest pollution load always occurred. With the course of time this condition moved higher in the water column. Subsequently, the water circulation in the reservoir increased, and oxygen, pollution, and nutrients became more equalized throughout the water column. (Cassar-FRC)
W81-02247

AQUATIC MACROPHYTES AS INDICATOR FOR HEAVY METAL POLLUTION IN THE RIVER LEINE (WEST GERMANY). (MAKROPHYTISCHE WASSERPFLANZEN ALS BIOINDIKATOREN FUR DIE SCHWERMETALL-BELASTUNG DER OBEREN LEINE),
Institut fuer Physische Geographie, Frankfurt-am-Main (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W81-02252

RESISTANCE OF NUTRIENT CYCLING SYSTEMS TO PERTURBATIONS OF THE FLOW RATES,
Georgia Univ., Athens. Dept. of Mathematics.
For primary bibliographic entry see Field 7B.
W81-02258

POLIOVIRUS INTERACTION WITH MONTMORILLONITE CLAY: ELECTRON MICROSCOPY AND FLOCCULATION STUDIES,
California Univ., Los Angeles. Dept. of Engineering and Applied Science.
P. C. Butler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182222, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis in Engineering, 1980. 78 p, 18 Fig, 6 Tab, 3 Append. (California Water Resources Center Project UCAL-WRC-W-523). OWRT-B-184-CAL(9).

Descriptors: *Viruses, *Water reuse, *Soil properties, *Groundwater, Adsorption, Water pollution.

The objective of this research was to gain an understanding of the interaction between montmorillonite clay particles and Type I poliovirus particles. This knowledge would be useful in the quantification of viral contamination of underground water reservoirs left after land treatment of waste water. Two topics were investigated: first, an attempt was made to photograph virus adsorbed on monodispersed clay particles; second, determination of the concentrations of clay, virus, and electrolyte which allowed the maintenance of monodispersed clay particle suspension was made. A drop of clay-virus suspension in an aqueous solution of ammonium bicarbonate, a volatile salt, was air-dried on an electron microscope sample holder. The samples were coated with gold, gold-palladium, or carbon to promote conductivity. Scanning electron micrographs were taken of the surface of clay particles. The micrographs showed virus attached to the edge of the plate-shaped clay particle. A count of viruses adsorbed on clay gave an average of 0.156 + or - 0.02 virus particles per clay particle. In the second study, suspensions containing variable concentrations of virus, clay and phosphate buffered saline (PBS) electrolyte were prepared and photomicrographs were taken to ascertain the extent of clay flocculation. Monodispersed clay suspensions were obtained only in suspensions containing the highest virus concentration tested. (Snyder-California)
W81-02271

POLIOVIRUS TYPE I ADSORPTION TO CRUSHED OTTAWA SAND AT HIGH TITRES.
California Univ., Los Angeles. Dept. of Engineering.
J. C. Fong.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182263, Price codes: A04 in paper copy, A01 in microfiche. MS Thesis in Engineering, 1980. 54 p, 4 Fig, 4 Tab, 4 Append. (California Water Resources Center Project UCAL-WRC-W-523). OWRT-B-184-CAL(8).

Descriptors: *Viruses, *Reclaimed water, Soils, Percolation, Sands, Water reuse, *Groundwater, Adsorption, *Soil properties, Mathematical models.

This thesis investigates the removal capacity of crushed Ottawa sand for poliovirus type I (Sabin strain). The need for this study arises from the possible survival and transmission of enteric viruses from reclaimed water through soil beds which may contaminate the groundwater supply. Sand was studied because it is a very common soil constituent. Characterization of the sand was achieved by photomicroscopy using a truncated multiple traversing technique. The particle size distribution fitted a normal distribution with an average Feret's diameter of 122.9 mu. The removal of poliovirus by the sand conformed to a Langmuir isotherm of which the parameters were found to be Q=2.74E+08 virus sites per mg of adsorbent and an adsorption equilibrium constant of 1.51E-08. The percentage of surface area utilized for virus adsorption was calculated to be 1.35% from the parameters found. This low percentage is believed to be because virus attachment is along the edge surfaces. (Snyder-California)
W81-02272

NONPOINT POLLUTION CONTROL -- TOOLS AND TECHNIQUES FOR THE FUTURE, PROCEEDINGS OF A TECHNICAL SYMPOSIUM.
For primary bibliographic entry see Field 5G.
W81-02276

NONPOINT POLLUTION CONTROL FROM THE STANDPOINT OF RESEARCH.
Office of Water Research and Technology, Washington, DC.
For primary bibliographic entry see Field 5G.
W81-02277

NATIONAL PERSPECTIVES ON NONPOINT POLLUTION CONTROL.
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 5G.
W81-02278

QUANTIFICATION OF NUTRIENT LOADINGS TO THE CHESAPEAKE BAY: A STRATEGY.
Environmental Protection Agency, Annapolis, MD. Chesapeake Bay Program
For primary bibliographic entry see Field 5A.
W81-02284

NONPOINT POLLUTION DATA COLLECTION PROBLEMS ON LOW FLAT COASTAL TOPOGRAPHY.
Delaware Univ., Newark. Dept. of Agricultural Engineering.
K. M. Lomax, J. C. Stevenson, M. S. Christy, and J. R. Todd.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 46-52, 1981. 1 Tab, 9 Ref

Descriptors: *Maryland, *Eastern Shore, *Nonpoint pollution sources, *Surface runoff, *Agricultural runoff, Forests, Small watersheds, Topography, Land use, Coastal plains, Tidal effects, Flow measurement, Flowmeters, Groundwater movement.

Pollution contribution from nonpoint sources was studied using data gathered from an agricultural watershed and from a forested watershed on Maryland's Eastern Shore. The agricultural watershed had 54 hectares of cropland and 32 hectares of roads, grass, ditches, and woods. The forested watershed had 33 hectares of 50 year old loblolly pines with no significant roads, houses, grass, or ditches. The flatness of the area made flow and watershed boundary determinations very difficult. Ditch patterns were found to control surface water flow and visual observation during a flow event was finally used to define the watersheds. Problems were also experienced during flow measurement with Parshall flumes due to their inability to measure small flows. Runoff measurement was further complicated by tidal effects and by the relatively high concentration of chloride in the groundwater. Due to the lowness of the watersheds, about 290 groundwater wells were drilled to study the hydrologic patterns of the area. Three years of measurements showed that as expected the forested watershed had less surface water runoff than did the agricultural watershed. Also, direct groundwater movement did not appear to be a significant hydrologic factor. (See also W81-02276) (Seigler-IPA)
W81-02285

NONPOINT SOURCES AND IMPACTS IN A SMALL COASTAL PLAIN ESTUARY: A CASE STUDY OF THE WARE RIVER BASIN, VIRGINIA.
Virginia Inst. of Marine Science, Gloucester Point. G. Anderson, and C. Bosco.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 53-63, 1981. 2 Fig, 2 Tab, 26 Ref.

Descriptors: *Virginia, *Ware River, *Chesapeake Bay, *Storm runoff, Surface runoff, *Nonpoint pollution sources, Agricultural runoff, Forests, Urban runoff, Estuaries, Coastal plains, Topography, Land use, Rural areas, Infiltration, Average runoff.

The Ware River, a mesohaline sub-estuary located on the southwestern shore of the Chesapeake Bay, was used to study the characteristics of runoff from low relief coastal plain environments and their impacts on small estuarine receiving waters. The Ware basin is a small drainage area of 59.4 sq miles with rural land use. Four small drainage catchments were studied, a residential site, a forested site, and two agricultural sites. Eight months of runoff data showed runoff rates for the four sites to be well above average with runoff from the residential site being ten times more than the long term average. Loading values for various chemical constituents were lower than expected. The residential site produced the highest loads and the upland agricultural site produced the lowest areal loads. Loading rates appeared to be dependent on the areal water yield of each catchment except for the forested site. Results also indicate that the extent, duration, and severity of impacts on the estuarine Ware River following a major storm are slight. (See also W81-02276) (Seigler-IPA)
W81-02286

NONPOINT CONTRIBUTIONS FROM AGRICULTURAL ACTIVITIES IN THE MARYLAND PIEDMONT.
Maryland Univ., College Park. Dept. of Agricultural Engineering
J. E. Ayars, J. C. Inman, and G. McClung
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 74-81, 1981. 4 Tab, 8 Ref

Descriptors: *Howard County, Maryland, *Nonpoint pollution sources, *Rainfall runoff relationships, *Agricultural watersheds, Surface runoff, Phosphorus, Water quality, Water sampling, Monitoring, Land use, Alfalfa, Corn(Field), Demonstration watersheds, Cattle, Hogs

Runoff quality and quantity were monitored for the following land use areas in Howard County, Maryland: conventional tilled corn, minimum tilled corn, alfalfa, swine grazing, and cattle grazing. Watersheds monitored were selected so that each represented a single land use activity. H-type flumes with Stevens type F water stage recorders were used to measure runoff. Meteorological data recorded included pan evaporation, wind run, temperature, rainfall, humidity, and solar radiation. Nutrient and sediment loading rates were calculated using nutrient and sediment concentrations from stage integrated samplers and volumes from water stage recorders. Results show that minimum tillage is effective in reducing sediment loss as illustrated by the corn watersheds and areas with good surface cover. All watersheds showed fairly constant soluble phosphorus concentrations in runoff during the entire growing season. Most phosphorus appears to be sediment. The tilled corn watershed had the highest sediment concentration and the highest phosphorus concentration. Highest total phosphorus values were found during August and September. (See also W81-02276) (Seigler-IPA)
W81-02288

EVALUATION OF URBAN STORMWATER QUALITY AND NONSTRUCTURAL BEST MANAGEMENT PRACTICES.
Philadelphia Water Dept., PA
W. G. Richards, J. E. Shwop, and R. Romano
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 82-99, 1981. 4 Fig, 8 Tab, 13 Ref

Descriptors: *Philadelphia, Pennsylvania, *Urban runoff, *Nonpoint pollution sources, *Storm runoff, Urbanization, Street cleaning, Land use, Residential areas, Industries, Data bases, Best Management Practices, Suspended solids, Water pollution sources

Two urban stormwater sampling programs were conducted along with a detailed study of street cleaning and stormwater in Philadelphia, Pennsylvania, to analyze the effects of land use and best management practices on nonpoint sources of water pollution in urban areas. The first study characterized stormwater loads according to nine uniform land use types to provide a data base for stormwater loading projections and for estimating total nonpoint urban stormwater loads. Industrial and commercial areas were found to have greater input during storm events than residential areas, however, housing density in residential areas was a significant factor. A comparison of the data bases from the first study and from the second study which used a mixed land use basin showed that projected storm loads for most parameters were within a factor of two from the measured values

Two non-structural methods for controlling urban stormwater, street cleaning and inlet basin cleaning, were examined. Street cleaning produced a 30% reduction in pollutant loadings while inlet basin cleaning produced a 780% increase in suspended solids load immediately after cleaning. Recommendations for changing inlet basin cleaning methods were made. (See also W81-02276) (Seigler-IPA)
W81-02289

A FIELD-SCALE MODEL FOR NONPOINT SOURCE POLLUTION EVALUATION,
Science and Education Administration, Tucson., AZ. Southwest Watershed Center.
For primary bibliographic entry see Field 5A.
W81-02290

MODELING DAIRY FARM OPERATOR RESPONSE TO NONPOINT SOURCE CONTROL REGULATIONS,
Economics and Statistics Service, Broomall, PA.
R. E. Heimlich, and S. Stachowski.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 107-118, 1981. 2 Fig, 1 Tab, 27 Ref.

Descriptors: *Vermont, *Nonpoint pollution sources, *Dairy farms, *Computer models, Model studies, Manure, Agricultural runoff, Nutrients, Environmental effects, Farm wastes, Livestock, Cattle, Erosion, Sedimentation.

A linear programming model of an individual dairy farm was constructed to assess the environmental and financial impacts of nonpoint control measures used on dairy farms in Vermont. It is estimated that dairy farms account for most of the nonpoint nutrient load from Vermont agriculture due to runoff of nutrients from animal manure and commercial fertilizer. The model can be used to simulate alternative nonpoint control methods so that their impact, on nutrient losses and change in farm income, can be compared to a base situation. The model operates in a single year period and emphasizes short-run profit maximizing. Three simulating components are used: dairy operations, financial results, and resource and environmental results. Dairy operations include herd management, herd feeding, crop production, and manure handling. Resource and environmental results separates potential pollutants into erosion and sedimentation or nutrients. Financial components include: current income and expenses, debt structure, and taxes and subsidy programs. (See also W81-02276) (Seigler-IPA)
W81-02291

HSPF: A COMPREHENSIVE PACKAGE FOR SIMULATION OF WATERSHED HYDROLOGY AND WATER QUALITY,
Environmental Research Lab., Athens, GA.
For primary bibliographic entry see Field 6A.
W81-02294

A METHODOLOGY FOR ESTIMATING THE LOADS AND IMPACTS OF NONPOINT SOURCES ON LAKE AND STREAM WATER QUALITY,
Center for the Environment and Man, Inc., Hartford, CT.
For primary bibliographic entry see Field 6A.
W81-02295

NEW METHODOLOGIES TO EVALUATE BEST MANAGEMENT PRACTICES,
CH2M/Hill, Reston, VA.
For primary bibliographic entry see Field 6A.
W81-02296

POLLUTANT EXPORT FROM SMALL CATCHMENTS EXHIBITING DIFFERENT AGRICULTURAL USES AND MANAGEMENT PRACTICES,
Occoquan Watershed Monitoring Lab., Manassas, VA.
B. L. Weand, W. F. McTernan, T. J. Grizzard, C. W. Randall, and R. C. Hoehn.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 188-198, 1981. 6 Fig, 3 Tab, 9 Ref.

Descriptors: *Nonpoint pollution sources, *Virginia, *Land use, *Agricultural runoff, *Water pollution sources, Management practices, Sediments, Erosion, Agricultural watersheds, Occoquan watershed, Grazing, Pasture management, Corn(Field), Watershed management.

Six sites in the Occoquan watershed were monitored to characterize nonpoint pollution from various land uses and to evaluate the effectiveness of selected management practices. The study sites were located in Prince William and Fauquier Counties, Virginia. Four of the sites were agricultural and were paired as heavily grazed and lightly grazed, and as minimum-till and no-till corn croplands. Other sites monitored were effluent from a farm stock pond and drainage from a small hardwood forest. All sites were equipped with type-H flumes for primary flow control along with pressure transducer type flowmeters. Samples were collected automatically during storm events and were analyzed for: total suspended solids, total Kjekdahl nitrogen, soluble Kjeldahl nitrogen, ammonia nitrogen, nitrate plus nitrite nitrogen, soluble orthophosphorus, total soluble phosphorus, and total phosphorus. Results show that the heavily grazed area consistently exported more pollutants than the lightly grazed area. No-till corn, in general, produced lower concentrations than the minimum-till corn. Extreme events did produce higher loading at the no-till site than at the minimum-till site. (See also W81-02276) (Seigler-IPA)
W81-02298

THE DEVELOPMENT AND CONTENT OF THE AGRICULTURAL COMPONENT OF THE MARYLAND 208 PLAN,
Soil Conservation Service, College Park, MD.
For primary bibliographic entry see Field 5G.
W81-02302

SELECTION OF POTENTIALLY CRITICAL AREAS FOR AGRICULTURAL LIVESTOCK WASTE IN MARYLAND,
Cooperative Extension Service, Centerville, MD.
For primary bibliographic entry see Field 6B.
W81-02303

RELEASE, DISTRIBUTION, AND IMPACTS OF POLYCHLORINATED BIPHENYLS (PCB) INDUCED BY DREDGED MATERIAL DISPOSAL ACTIVITIES AT A DEEPWATER ESTUARINE SITE,
URS Co., Seattle, WA.
S. P. Pavlou, R. N. Dexter, D. E. Anderson, E. A. Quinlan, and W. Hom.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173825, Price codes: A13 in paper copy, A01 in microfiche.
In: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the Fifth United States-Japan Experts Meeting, Nov. 1979, New Orleans, LA. EPA Report EPA-600/9-80-044, Sep. 1980, p 129-174. 26 Fig, 4 Tab, 9 Ref. DACW39-79-C-0038.

Descriptors: *Polychlorinated biphenyls, *Dredging, *Sediments, *Environmental effects, *Estuaries, Puget Sound(WA), Duwamish River(WA), River beds, Water pollution, Suspended solids, Marine animals, Clams, Worms, Crustaceans, Statistics, *Washington.

Short-term and long-term ecological impact studies were initiated at the time of open-water disposal of contaminated dredged material from the Duwamish River in Elliott Bay, Puget Sound, Washington. The experimental disposal site was located at a depth of 60 m in a marine estuary with generally weak circulation. Approximately 114,000 cubic meters of dredged material contaminated with PCB's were dumped at the site from split-hull barges. Replicate water, suspended particulate matter, and sediment samples were taken at intervals up to 9 months after disposal and investigated for PCB content. The PCB concentration in water and suspended matter generally declined over time. The sediments at the disposal site were slumping from the center of the site to the periphery during the monitoring period, and there was a slight but not significant reduction in PCB concentrations. Long-term (3-years post-disposal) PCB concentrations showed further declines, with the highest concentrations in the vicinity of the disposal site. Macrofauna, including marine worms, clams and crustaceans, was collected by grab sampler. Statistical analysis of the abundance figures suggest that some taxa may be more abundant within and close to the disposal site, and that stations in close proximity to the grid are more similar to each other than to more distant stations. Nonparametric Wilcoxon two-sample tests revealed significant differences in abundances for none taxa that were grouped as stations within the grid site versus more distant stations. All but one of the taxa exhibited greater abundances at the disposal site. (Brambley-SRC)
W81-02321

CONTAMINANT MOBILITY IN DIKED CONTAINMENT AREAS,
Army Engineers Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
R. E. Hoeppel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173825, Price codes: A13 in paper copy, A01 in microfiche.
In: Mangement of Bottom Sediments Containing Toxic Substances, Proceedings of the Fifth United States-Japan Experts Meeting, Nov 1979, New Orleans, LA. Environmental Protection Agency Rpt EPA-600/9-80-044, Sep 1980, p 175-207. 7 Fig, 3 Tab, 20 Ref.

Descriptors: *Water quality control, *Dredging, *Waste disposal, *Settling basins, *Suspended solids, Heavy metals, Estuaries, Lakes, Rivers, Pesticides, Plant growth, Water quality standards, Sediments, River beds, Polychlorinated biphenyls, Ammonia.

Nine dredged material land containment areas, located at upland, lowland and island sites, were monitored during hydraulic dredging operations in fresh and brackish-water riverine, lake, and estuarine environments. Influent-effluent sampling at the diked disposal areas showed that, with proper retention of suspended solids, most chemical constituents could be removed to near background water levels. Most heavy metals, oil and grease, chlorinatd pesticides, and PCB's were almost totally associated with solids in influent and effluent samples. Ammonia, manganese, total mercury and possibly iron, copper and zinc are the only contaminants which may occasionally exceed background water levels and present water quality standards after suspended solids removal. Actively growing vegetation appeared to be efficient in reducing ammonium nitrogen to low levels and for filtering out suspended solids. Confined land disposal of dredged material seems to be a viable method for the containment and treatment of most contaminated sediments, but effluent monitoring and predictive testing methodologies should include suspended solids. (Brambley-SRC)
W81-02322

DISSOLVED OXYGEN AND TEMPERATURE SURVEY OF THE LOWER SUSQUEHANNA RIVER, AUGUST 9TH AND 10TH, 1979,
Susquehanna River Basin Commission, Harrisburg, PA.
For primary bibliographic entry see Field 5A.
W81-02338

QUALITY OF RUNOFF FROM SMALL WATERSHEDS IN THE TWIN CITIES METROPOLITAN AREA, MINNESOTA--A PROJECT PLAN,
Geological Survey, St. Paul, MN. Water Resources Div.
M. A. Ayers, G. A. Payne, and G. L. Oberts.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225. Price: $ 2.00 in paper

copy, $3.50 in microfiche. Geological Survey Open-File Report 80-592, 1980. 31 p, 13 Fig, 6 Tab, 7 Ref.

Descriptors: *Water quality, *Storm runoff, *Small watersheds, *Urban hydrology, *Minnesota, Land use, Water pollution sources, Water supply, Analytical techniques, Data collections, Sampling, Water analysis, Sediments, Nutrients, *Twin Cities metropolitan area(MN).

A program for water-quality sampling to define the relationships between land use, watershed characteristics, and the quantity, quality, and timing of runoff has been started for the Twin Cities metropolitan area of Minnesota. Ten major watersheds were chosen as representative of conditions in the metropolitan area. Each will be sampled at one location near the outlet. Six of the watersheds are agricultural, and range in size from 14.3 to 82.9 square miles. The four remaining watersheds are urbanized and range in size from 1.22 to 31.7 square miles. In addition, seven urban subwatersheds, which range in size from 0.12 to 0.47 square mile and reflect a dominant land-use type, will be sampled. Data collection is designed around the hydrologic conditions expected for each site. Sixteen of 17 sites are instrumented to define stream discharge and 12 sites have automatic water samplers and recording rain gages. In addition, six sites will have automatic wetfall/dryfall precipitation collectors. Samples for analysis of 32 chemical, physical, and biological constituents will be collected at varying frequencies, with emphasis on storm sampling for suspended solids and nutrients. A data-management system being designed for the U.S. Geological Survey Urban Hydrology Studies Program will facilitate data processing. Data interpretation will be aimed at defining the quantity and quality characteristics of runoff from study watersheds. These findings will be extrapolated to unsampled watersheds in the metropolitan area. (USGS)
W81-02354

WATER-QUALITY RECONNAISSANCE OF THE PASCAGOULA AND ESCATAWPA RIVERS, JACKSON COUNTY, MISSISSIPPI-MAY 1974 TO JULY 1978,
Geological Survey, Doraville, GA. Water Resources Div.
R. E. Faye.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $14.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-727, 1980. 105 p, 15 Fig, 4 Tab, 6 Ref.

Descriptors: *Water quality, Surveys, *Data collections, *Mississippi, *Estuaries, Streamflow, Waste water, Water pollution sources, Tidal waters, Biochemical oxygen demand, Nutrients, Trace elements, Nitrification, Water analysis, Hydrologic data, Pascagoula River(MS), Escatawpa River(MS), *Jackson County(MS), Path of pollutants, Tidal effects.

Short-term, water-quality reconnaissances along the downstream reaches of the Pascagoula and Escatawpa Rivers in Jackson County, Miss., indicate that stream quality during the period May 1974 to July 1978 was affected by wastewater discharges as well as river discharge and the extent of tidal intrusion. Specific conductances on the Pascagoula River ranged from less than 100 to more than 40,000 micromhos per centimeter and increased downstream. Specific conductance also increased with depth at downstram sites, indicating density stratification. Dissolved-oxygen concentrations were also affected by density stratification but were generally greater than 4.0 milligrams per liter in both rivers. Analyses of 5-day biochemical oxygen demand and nutrient concentrations indicate that oxidation of both carbonaceous and nitrogenous materials significantly affected the waste assimilative capacity of the rivers. Concentrations of pesticides and most trace elements in both the water column and the bottom sediments were zero or very small. Titanium concentrations were less than 220 micrograms per liter in the water column and 6,500 micrograms per gram in bottom sediments. Small concentrations of oil and grease, PCB's, and phenols were also detected. Fecal coliform and fecal streptococcal bacteria concentrations were generally greater in the Escatawpa River and ranged from about 10 to 18,000 colonies per 100 milliliters of water. (USGS)
W81-02362

CAPE CODE AQUIFER, CAPE COD, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02364

HYDROGEOCHEMISTRY AND SIMULATED SOLUTE TRANSPORT, PICEANCE BASIN, NORTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
S. G. Robson, and G. J. Saulnier, Jr.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225. Price: $12.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-72, April, 1980. 89 p, 45 Fig, 4 Tab, 65 Ref

Descriptors: Geochemistry, *Groundwater, *Oil shales, *Mine drainage, *Colorado, Model studies, Aquifer characteristics, Water quality, *Water pollution sources, Surface-groundwater relationships, *Piceance basin(CO), Solute-transport modeling

Oil-shale mining activities in Piceance basin in northwestern Colorado could adversely affect the ground- and surface-water quality in the basin. This study of the hydrology and geochemistry of the area used groundwater solute-transport-modeling techniques to investigate the possible impact of the mines on water quality. Maps of the extent and structure of the aquifer were prepared and show that a saturated thickness of 2,000 feet occurs in the northeast part of the basin. Ground-water recharge in the upland areas in the east, south, and west parts of the basin moves down into deeper zones in the aquifer and laterally to the discharge areas along Piceance and Yellow Creeks. The saline zone and the unsaturated zone provide the majority of the dissolved solids found in the ground water. Precipitation, ion-exchange, and oxidation-reduction reactions are also occurring in the aquifer. Model simulations of groundwater pumpage in tracts C-a and C-b indicate that the altered direction of groundwater movement near the pumped mines will cause an improvement in groundwater quality near the mines and a degradation of water quality downgradient from the tracts. Model simulations of mine leaching in tract C-a and C-b indicate that equal rates of mine leaching in the tracts will produce much different effects on the water quality in the basin. Tract C-a, by virtue of its remote location from perennial streams, will primarily degrade the groundwater quality over a large area to the northeast of the tract. Tract C-b, by contrast, will primarily degrade the surface-water quality in Piceance Creek, with only localized effects on the groundwater quality. (USGS)
W81-02366

PALEOHYDROLOGY OF THE SOUTHERN GREAT BASIN, WITH SPECIAL REFERENCE TO WATER TABLE FLUCTUATIONS BENEATH THE NEVADA TEST SITE DURING THE LATE( ) PLEISTOCENE,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5E.
W81-02372

QUALITY OF SURFACE WATER IN THE COAL-MINING REGION, SOUTHWESTERN INDIANA, MARCH AND MAY 1979,
Geological Survey, Indianapolis, IN. Water Resources Div.
D. E. Renn, S. E. Ragone, and W. G. Wilber.
Available from the OFSS, USGS Box 25425, Fed Ctr., Denver, CO 80225, Price: $8.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-970, September, 1980. 65 p, 21 Fig, 15 Tab, 7 Ref

Descriptors: Data collections, Networks, *Water quality, *Surface waters, *Indiana, *Strip mines, Water analysis, Heavy metals, Air temperature, Precipitation(Atmospheric), Streambeds, Streamflow, Hydrologic data, Sampling, Sites, Southwestern Indiana, Coal mining, *Path of pollutants, *Mine wastes

On August 3, 1977, the Surface Mine Control and Reclamation Act, Public Law 95-87 (the Act) was enacted by the 95th Congress. Under Section 507(b)(11) of the Act, an appropriate Federal or State agency must provide applicants for coal-mining permits hydrologic and water-quality information for the general use of proposed mining. To help meet the goals of the Act, the U.S. Geological Survey is designing a data-collection network in the coal-mining region of southwestern Indiana. The purpose of the network is to provide hydrologic and water-quality data on the 'general area' for coal-mining permits. Because of the large size of the study area and the lack of hydrologic and water-quality data, a preliminary assessment is being done to determine the factors that affect water quality in the coal-mining region. This information will be used in designing a data network that will (1) provide the hydrologic and water-quality data needed by applicants for coal-mining permits and (2) determine the major factors that affect water quality. Reconnaissance data were collected at 293 sites in March, and hydrologic and water-quality data were collected at 84 synoptic sampling sites in May. (Synoptic sampling is the virtually simultaneous collection of data at specific sites.) In the reconnaissance, pH, specific conductance, dissolved-oxygen concentration, temperature, and Eh of streams were measured on site to provide general water-quality data. In the synoptic sampling, the preceding characteristics, as well as concentrations of various dissolved and suspended constituents of stream water and concentrations of heavy metals on streambed materials, were determined. (USGS)
W81-02384

DATA FROM A HYDROLOGIC RECONNAISSANCE OF THE BELUGA, PETERS CREEK, AND HEALY COAL AREAS, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
D. R. Scully, A. P. Krumhardt, and D. R. Kernodle.
Geological Survey Open-File Report 80-1206, 1980. 54 p, 1 Fig, 1 Tab.

Descriptors: Data collections, *Streamflow, *Water quality, *Groundwater, *Alaska, *Coal mining, Surveys, Springs, Discharge(Water), Sampling, Benthic fauna, Invertebrates, Path of pollutants, Beluga coal area(AK), Peters Creek coal area(AK), Healy coal area(AK)

Data are tabulated from a hydrologic study of the Beluga, Peters Creek, and Healy coal areas in Alaska from July 1975 to June 1979. These include streamflow and water-quality data for all three areas, groundwater data for the Beluga and Healy coal areas, and information from springs in the Beluga coal area. Results of analyses of samples of the benthic invertebrate community in the Beluga area are also included. (USGS)
W81-02385

HYDRAULIC CHARACTERISTICS OF AN UNDERDRAINED IRRIGATION CIRCLE, MUSKEGON COUNTY WASTE WATER DISPOSAL SYSTEM, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
M. G. McDonald
Available from the OFSS, USGS Box 25425, Fed Ctr., Denver, CO 80225, Price: $2.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-773, June, 1980. 18 p, 9 Fig, 9 Ref.

Descriptors: *Hydraulic conductivity, *Groundwater movement, *Waste water disposal, *Sprinkler irrigation, *Michigan, Computer models, Groundwater recharge, Aquifer characteristics,

Aquitards, Geohydrologic units, Drainage systems, Numerical analysis, Hydrogeology, Evaluation, *Muskegon County(MI).

Muskegon County, Mich., disposes of wastewater by spray irrigating farmland on its waste-disposal site. Buried drains in the highly permeable unconfined aquifer at the site control the level of the water table. Hydraulic conductivity of the aquifer and drain leakance, the reciprocal of resistance to flow into the drains, was determined at a representative irrigation circle while calibrating a model of the ground-water flow system. Hydraulic conductivity is .00055 meter per second, in the north zone of the circle, and .00039 meter per second in the south zone. Drain leakance is low in both zones: 0.0000029 meter per second in the north and 0.0000095 meter per second in the south. Low drain leakance is responsible for waterlogging when irrigation rates are maintained at design levels. The capacity of the study circle to accept wastewater has been reduced by more than 35%. (USGS)
W81-02388

QUALITY OF WATER IN THE PEARL RIVER, JACKSON TO BYRAM, MISSISSIPPI, SEPTEMBER 21-22, 1976,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02392

SUMMARY OF WATER-QUALITY DATA FOR SELECTED STREAMS IN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02394

CALIBRATION AND POTENTIAL USES OF A DIGITAL WATER-QUALITY MODEL FOR THE ARKANSAS RIVER IN PUEBLO COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
K. E. Goddard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124760, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-38, 1980. 87 p, 22 Fig, 12 Tab.

Descriptors: *Water quality, *Rivers, *Model studies, *Colorado, Projections, Analytical techniques, Computer models, Simulation analysis, Data collections, Reaeration rates, Nutrients, Water pollution control, Waste assimilative capacity, Evaluation, *Arkansas River(CO), *Pueblo County(CO).

The U.S. Geological Survey conducted a 1-year study to calibrate and demonstrate the use of a steady-state water quality model for a 42-mile reach of the Arkansas River in Pueblo County, Colo. Based on the calibration, the model is capable of accurately predicting concentrations of carbonaceous biochemical oxygen demand, total organic nitrogen, total nitrite, and total orthophosphate; predicted concentrations of total ammonia, total nitrate, and dissolved oxygen will be somewhat less accurate. Additional data are needed to determine the model's capability to predict concentrations of coliform bacteria. Potential uses of the model were demonstrated by simulating the effects of different waste water discharges on streamflow quality, using water-quality and stream-discharge data provided by the Pueblo Area Council of Governments. Selected results for carbonaceous biochemical oxygen demand and total ammonia from three simulations illustrate the capability of the model. (USGS)
W81-02395

SALINE WATER AT THE BASE OF THE GLACIAL-OUTWASH AQUIFER NEAR VINCENNES, KNOX COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02396

5C. Effects Of Pollution

PHYSICAL VARIABILITY AND PHYTOPLANKTON COMMUNITIES: I. THE DESCRIPTIVE LIMNOLOGY OF HAMILTON HARBOUR,
McMaster Univ., Hamilton (Ontario). Dept. of Biology.
G. P. Harris, B. B. Piccinin, G. D. Haffner, W. Snodgrass, and J. Polak.
Archiv fur Hydrobiologie, Vol 88, No 3, p 303-327, April, 1980. 13 Fig, 1 Tab, 30 Ref.

Descriptors: *Water pollution effects, *Hamilton Harbour, *Eutrophication, Fluctuations, Phytoplankton, *Lake Ontario, Canada, Limnology, Biomass, Algae, Phosphorus compounds, Nitrogen compounds, Dissolved oxygen, Stratification, Nutrients, Silica, Municipal wastes, Industrial wastes.

Hamilton Harbour, Lake Ontario, Canada, receives a number of municipal and industrial effluents. The physical and chemical features of this water have been studied during 1975-1977 to determine the effects of this pollution. The harbor could be classified as extremely eutrophic on the basis of its high phosphorus (10.5 g per sq meter per year) and nitrogen (320 g per sq meter per year) loadings and low dissolved oxygen, but its algal standing crop and primary productivity indicate a meso-eutrophic situation. This is a result of extreme fluctuations in water movement and thermal conditions as well as exchange with Lake Ontario. Concentrations of soluble reactive phosphorus, soluble reactive silica, and total phosphorus fluctuated and showed little correlation with the phytoplankton biomass. This is the first in a series of papers describing the effects of physical processes on the phytoplankton community in Hamilton Harbour. (Cassar-FRC)
W81-02181

THE COMPOSITION AND ECOLOGY OF PERIPHYTON COMMUNITIES IN FRESHWATERS. I. THE INFLUENCE OF HOST TYPE AND EXTERNAL ENVIRONMENT ON COMMUNITY COMPOSITION,
University of East Anglia, Norwich (England). School of Environmental Sciences.
D. Eminson, and B. Moss.
British Phycological Journal, Vol 15, No 4, p 429-446, December, 1980. 4 Fig, 5 Tab, 44 Ref.

Descriptors: *Eutrophication, *Lakes, *Algae, *Nutrients, Speciation, Phytoplankton, Aquatic plants, Water pollution effects, Limnology, Adaptation, Otis Lake, Michigan, *Periphyton, Distribution, Hickling Broad, United Kingdom.

The periphyton community in nutrient-rich lakes reflects the external environmental conditions rather than the specialized conditions near the macrophyte surfaces. In infertile lakes the periphyton community is highly host-specific because it has adapted to nutrient uptake at low concentrations and has low growth rates adjusted to nutrient supply. Observations in a very fertile lake, Hickling Broad, showed great similarity among the periphyton community (dominated by diatoms and Scenedesmus) of the macrophyte species. Nevertheless, some specificity was shown. In Otis Lake, Michigan, an infertile lake, desmids, filamentous Conjugatophyceae and other chlorophyta were common. The four macrophytes investigated here, although sharing some species, each had several species not found in large numbers near the others. (Cassar-FRC)
W81-02182

STUDIES ON THE TOXICITY OF PULP AND PAPER MILL EFFLUENTS - II. MUTAGENICITY OF THE EXTRACTS OF THE LIVER FROM SPOTTED SEA TROUT (NIBEA MITSUKURII),
Shizuoka Coll. of Pharmaceutical Sciences (Japan).
For primary bibliographic entry see Field 5A.
W81-02183

PHYTOPLANKTON FROM SWEDISH LAKES. III. LAKE HUNDSJON AND OTHER KETTLE LAKES OF CENTRAL SWEDEN,
National Swedish Environment Protection Board, Uppsala. Water Quality Lab.
For primary bibliographic entry see Field 2H.
W81-02184

EFFECT OF OXYGEN REDUCTION RATE AND CONSTANT LOW DISSOLVED OXYGEN CONCENTRATIONS ON TWO ESTUARINE FISH,
Johns Hopkins Univ., Laural, MD. Applied Physics Lab.
D. T. Burton, L. B. Richardson, and C. J. Moore.
Transactions of the American Fisheries Society, Vol 109, No 5, p 552-557, September, 1980. 2 Fig, 2 Tab, 30 Ref.

Descriptors: *Fishkill, *Dissolved oxygen, *Menhaden, *Spot, *Estuaries, Chesapeake Bay, Stratification, Water pollution effects, Laboratory studies, Oxygen reduction effects.

Lethal dissolved oxygen threshold concentrations at 28C were 1.1 and 0.7 mg per liter for Atlantic menhaden and spot. The 96 hour 5% lethal concentrations were 1.6 and 0.8 mg per liter, respectively. The rate of reduction of oxygen concentration (varying from 0.08 to 1.00 mg per liter hourly) did not affect the mean dissolved oxygen concentration at death (0.4 mg per liter). Thus the fish did not acclimatize to a low dissolved oxygen content. If the rate of oxygen reduction is constant, the time until fishkills occur can be determined from an inverse relationship between the LT50 and the rate of oxygen reduction. (Cassar-FRC)
W81-02185

DEGRADATION OF CHLOROPHENOLS IN SOIL, SEDIMENT, AND WATER AT LOW TEMPERATURE,
Waterloo Univ., (Ontario). Dept. of Biology.
M. D. Baker, C. I. Mayfield, and W. E. Inniss.
Water Research, Vol 14, No 12, p 1765-1771, December, 1980. 3 Fig, 3 Tab, 20 Ref.

Descriptors: *Microbial biodegradation, *Phenols, Soil microorganisms, *Chlorophenols.

A study to determine whether psychrotrophic microorganisms are capable of degrading chlorophenols in soil, water, and sediments is described. The effect these compounds have on psychrotrophic sediment microorganisms was also determined. Ortho-chlorophenol, para-chlorophenol, and 2,4-dichlorophenol were degraded by soil and sediment microorganisms at 0 deg C and 4C. Metachlorophenol and pentachlorophenol were also degraded, but to a lesser extent. Stream water microorganism were only able to degrade 2,4-dichlorophenol at 20C, and had no effects on others at 0 deg C or 20C. The addition of some chlorophenols was found to stimulate aerobic, and to some extent anaerobic, microbial growth in sediment incubated at 0 deg C. The concentration of some chlorophenols decreased in both sterile and nonsterile stream water at 0 deg C and 20C. This could not be explained by microbial contamination, photodecomposition, or volatilization. (Small-FRC)
W81-02193

ENVIRONMENTAL STUDY OF THE TAGUS ESTUARY,
Gore and Storrie Ltd., Toronto (Ontario).
M. Palmer, and T. R. Espirito Santo.
Nature and Resources, Vol 16, No 3, p 14-20, July/September, 1980. 1 Fig.

Descriptors: *Tagus Estuary, *Estuaries, *Project planning, *Lisbon, Portugal, Planning, Water pollution effects, Water pollution sources, United Nations, Aquatic life.

Objectives for an environmental study of the Tagus Estuary, at Lisbon, Portugal, were developed. This 320 sq km body of water, used for fishing, transport, water supply, wildlife habitat, recreation, and receiving of wastes, is polluted

with industrial and municipal wastes. The preparatory phase of the project, completed in 1976, was a review of pertinent literature and historical data and development of individual study components such as water quality, sediment, plankton, and modelling the physical characteristics. The second phase, starting in 1978 and scheduled to last 3.5 years, involves analysis and interpretation of all gathered data. Its objective is the rational management of the estuary by a thorough understanding of all processes occurring in it. The final phase concerns integration of all individual studies and recommendations for control measures and further studies. The executing agency for this project is UNESCO. (Cassar-FRC)
W81-02205

GROWTH KINETICS OF FRESHWATER BACTERIAL POPULATIONS AND ISOLATED STRAINS,
National Research Inst. of Aquaculture. (Japan)
N. Tanaka, M. Onizawa, and H. Kadota.
Japanese Journal of Limnology, Vol 41, No 2, p 75-83, April, 1980. 7 Fig, 2 Tab, 5 Ref.

Descriptors: *Bacteria, *Growth rates, *Lakes, Nutrients, Freshwater, Lake Biwa, *Japan, Kinetics, Microorganisms, Aquatic microorganisms.

Natural bacterial populations and isolated strains from Lake Biwa, Japan, were used to study the relationship between growth rate and organic nutrient concentration. Kinetic parameters (half-saturation constants) of three groups of natural populations were counted on media with 3 different levels of peptone nutrient (0.5, 5, and 10 grams per liter) Results were 1.15, 0.82, and 0.49 mg per liter respectively. Under the same conditions, three isolates showed results of less than 0.005 to 6.94, 0.04 to 313, and 0.156 to 4,000 mg per liter respectively Different sizes of suspended particulates were studied. Most bacteria were found in the particles above 1.2 microns in size. This 1.2 micron fraction appeared to grow optimally in media with 4 g peptone per liter; 3-1.2 micron fraction in 2 g per liter; and 5-3 micron fraction, 0.25 g per liter (Cassar-FRC)
W81-02206

SIGNIFICANCE OF ALGAL EXTRACELLULAR PRODUCTS TO BACTERIA IN LAKES AND IN CULTURES,
Toronto Univ. (Ontario). Div. of Life Sciences.
For primary bibliographic entry see Field 2H.
W81-02216

PHYTOPLANKTON RESPONSE TO SEWAGE REDUCTION IN VATTERN, A LARGE OLIGOTROPHIC LAKE IN CENTRAL SWEDEN,
Uppsala Univ. (Sweden). Inst. of Limnology.
P. Olsen, and E. Willen.
Archiv fur Hydrobiologie, Vol 89, No 1/2, p 171-188, June, 1980. 7 Fig, 41 Ref.

Descriptors: *Phytoplankton, *Eutrophication, *Oligotrophy, Lake Vattern, *Sweden, Sewage, Aquatic algae, Algae, Diatoms, Cyanophyta, Lakes, Limnology, Water pollution effects, Phosphorus compounds, Biological oxygen demand, Chlorophyta, Waste water treatment.

After the water quality of Lake Vattern, a 1,912 sq km oligotrophic clear lake in Sweden, deteriorated seriously in the mid 1960s, a purification program was initiated and completed in 1974. This involved biological and chemical treatment of sewage water in the entire drainage area and removal of a zinc ore dressing plant near the lake. Present indications are that the lake is returning to an oligotrophic state. When conditions reached a nadir in 1967, transparency was 6 meters (15-17 meters in 1980), phosphorus loading was 200 tons (50 tons in 1940's), BOD 13,000 tons, mostly from the pulp and paper industry, and biomass was 0.3 cu mm per liter. The most abundant species were those common in eutrophied lakes--diatoms, cryptomonads, green algae, and blue-green algae. More recent parameters are: Secchi disc reading of 15 meters in 1975, annual phosphorus loading 80 tons, annual BOD supply 3,000 tons, and standing crop of phytoplankton 0.07 cu mm per liter in 1971. In addition to the lowered plankton level maintained since 1971 (0.96 to 0.13 cu mm per liter) the diatoms, cryptomonads, green algae, and blue-green algae have decreased, and the chrysophytes and other oligotrophic indicators have become more prominent. (Cassar-FRC)
W81-02222

EUTROPHICATION PARAMETERS AND TROPHIC STATE INDICES IN 30 SWEDISH WASTE-RECEIVING LAKES,
National Swedish Environment Protection Board, Uppsala. Algal Assay Lab
C. Forsberg, and S-O. Ryding
Archiv fur Hydrobiologie, Vol 89, No 1/2, p 189-207, June, 1980. 7 Fig, 4 Tab, 34 Ref

Descriptors: *Eutrophication, *Lakes, *Classification, *Sweden, Limnology, Chlorophyll, Trophic level, Nitrogen compounds, Phosphorus compounds, Nutrients, Turbidity, Light penetration, Algae, Waste water(Pollution), Water quality

A trophic classification scheme for lakes was developed after 4,500 water samples from 30 Swedish lakes had been analyzed and correlated over a 6-year period. Total nitrogen, total phosphorus, and chlorophyll are expressed in mg per cu meter and transparency in meters in the following listing, based on summer average values: oligotrophic--N less than 400, P less than 15, chlorophyll less than 3, and transparency less than 4.0; mesotrophic--N 400-600, P 15-25, chlorophyll 3-7, and transparency 2.5-4.0; eutrophic--N 600-1500, P 25-100, chlorophyll 7-40, and transparency 1.0-2.5; hypertrophic--N greater than 1500, P greater than 100, chlorophyll greater than 40, and transparency less than 1.0. Many proposed trophic classifications depend on only one parameter. These give misleading results in some cases, for example, when algal growth is inhibited by an unusual factor. A two-dimensional approach gives better information. In some situations, all four variables should be considered. (Cassar-FRC)
W81-02223

ALGAL ASSAY STUDIES OF WASTE WATER POLLUTED LAKES,
National Swedish Environment Protection Board, Uppsala. Algal Assay Lab.
For primary bibliographic entry see Field 5A.
W81-02224

ESTIMATED SAFE ZINC AND COPPER LEVELS FOR CHINOOK SALMON, ONCORHYNCHUS TSHAWYTSCHA, IN THE UPPER SACRAMENTO RIVER, CALIFORNIA,
California State Dept. of Fish and Game, Rancho Cordova. Water Pollution Control Lab.
B. J. Finlayson, and K. M. Verrue.
California Fish and Game, Vol 66, No 2, p 68-82, April, 1980. 1 Fig, 3 Tab, 25 Ref. 4 Append.

Descriptors: *Copper, *Zinc, *Salmon, *Toxicity, Growth stages, Chinook salmon, Fishkill, Upper *Sacramento River, California, Acid mine water, Mine wastes, Water pollution effects.

Chronic (83 days) and acute (96 hours) toxicity tests conducted on chinook salmon--eggs, alevins, and swim-up fry--indicated that 'safe' levels of copper and zinc were below 11 and 83 micrograms per liter, respectively. The investigation, prompted by fish kills from acid mine wastes with copper to zinc ratios of 1:2 to 1:12 in the upper Sacramento River, showed that 83 day LC50 values for eggs-to-fry salmon were as follows (all units in micrograms per liter): 1:3 ratio, Cu 44 and Zn 160; 1:6 ratio, Cu 27 and Zn 206; and 1:11 ratio, Cu 17 and Zn 253; demonstrating that the toxicities of Cu and Zn were additive. Fry previously unexposed to the trace metals showed lower tolerance to the 1:3 ratio (Cu 37 and Zn 132) and higher tolerance to the 1:6 and 1:11 ratios: Cu 29 and Zn 213, Cu 20 and Zn 279, respectively. Eggs showed a similarity to the other stages, alevins and fry, in tolerance to copper-zinc solutions. (Cassar-FRC)
W81-02225

FATE OF PETROLEUM HYDROCARBONS IN SEWAGE SLUDGE AFTER LAND DISPOSAL,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 5E.
W81-02226

AVOIDANCE RESPONSE OF JUVENILE CHROMIS PUNCTIPINNIS TO CHLORINATED SEAWATER,
Occidental Coll. Los Angeles, CA. Dept. of Biology
J. E. Hose, and R. J. Stoffel.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 6, p 929-935, December, 1980. 1 Fig, 5 Tab, 12 Ref.

Descriptors: *Powerplants, *Chlorination, *Fish behavior, *Effluents, Sea water, Aquatic habitats, Dishcarge(Water), Water temperature, Thermal pollution

In a study of the effects of chlorinated seawater power plant effluent, juvenile blacksmith fish (Chromis punctipinnis) totally avoided chlorinated seawater with total residual oxidant value (TRO) of 0.15-0.16 ppm and showed statistically significant avoidance at 0.08-0.10 ppm. Tests were conducted in a counterflow behavior chamber in which half the water was chlorinated. Size of fish was directly correlated with TRO avoidance level. When the chlorinated seawater was elevated 3C above the non-chlorinated water, fish totally avoided the water at 0.086 ppm TRO, about half that at the lower temperature. Winter (15C) and summer (20C) and discharge temperatures (24C) were compared. Total avoidance levels were 0.162, 0.152, and 0.132 ppm respectively. Fish in tanks with abundant brine shrimp available in the chlorinated water had an avoidance level of 0.203 ppm, compared with 0.162 ppm for fish with no readily available food supply. Starved fish were also more tolerant of chlorinated water, having a total avoidance level of 0.327 ppm compared with 0.175 ppm for satiated fish. (Cassar-FRC)
W81-02230

EFFECT OF 20- TO 30-DAY CONTINUOUS EXPOSURE OF TREATED BLEACHED KRAFT MILL EFFLUENT ON SELECTED FRESHWATER SPECIES,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
W. C. Graves, D. T. Burton, and L. B. Richardson.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 4, p 651-657, October, 1980. 2 Tab, 18 Ref

Descriptors: *Toxicity, *Fish, *Pulp and paper industry, *Pulp wastes, Laboratory tests, Fisheries, Effluents, Assay, Water analysis, Waste water treatment, *Industrial wastes

The efficiency of a waste treatment system employed at a large pulp and paper mill was evaluated by exposing several species of fish to composite effluent for varying lengths of time. The waste was treated using aerated stabilization basins, which have a reported 90% efficiency in reducing toxicity, biochemical oxygen demand, and resin acids. Thirty fish of each species were placed in aquaria with various effluent concentrations for 20 to 30 day periods. Although some mortality was observed during the study, no toxic effects were directly attributable to effluent exposure. The aerated stabilization basin produces effluent comparable in quality to that produced by other methods. (Titus-FRC)
W81-02232

ANAEROBIC METABOLISM OF PARTICULATE ORGANIC MATTER IN THE SEDIMENTS OF A HYPEREUTROPHIC LAKE,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station
For primary bibliographic entry see Field 2H.
W81-02241

QUANTIFICATION AND CHARACTERIZATION OF SEDIMENTING PARTICULATE ORGANIC MATTER IN A SHALLOW HYPEREUTROPHIC LAKE,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
For primary bibliographic entry see Field 2H.
W81-02242

HYDROCHEMICAL CHARACTERISTICS AND POLLUTION OF THE RIVER BIALA PRZEMSZA CATCHMENT BASIN,
Jagellonian Univ., Krakow (Poland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5B.
W81-02245

BIOLOGY OF THE NORTH ARM,
Utah State Univ., Logan. Dept. of Biology.
F. J. Post.
In: Great Salt Lake: A Scientific Historical and Economic Overview. Utah Geological and Mineral Survey, Utah Department of Natural Resources, Salt Lake City, Utah. Bulletin 116, p 313-321, 1980. OWRT-A-024-UTAH(8), 14-34-0001-6046.

Descriptors: Bacteria, Bacteriophage, *Saline lakes, Oxygen requirement, Algae, Brine shrimp, *Environmental effects, *Aquatic life, Biological communities, *Great Salt Lake, *Utah.

The extreme stress of high salt, about 360 g/l, and low oxygen solubility in the north arm of the Great Salt Lake has led to a biological community of low diversity and few species. Those organisms with adaptive mechanisms evolved to withstand the rigors of this harsh environment occur in numbers large enough to color the water a wine red. Nutrients seem abundantly available except for an inorganic source of nitrogen. The bacteria supply what little ammonia is available for the algae and the algae in turn excrete organic matter used by the bacteria. Organic nitrogen is plentiful but possibly in a form unavailable to the bacteria since it does not seem to support their growth. Each of the biological members, bacteria, bacteriophage, algae, brine fly and brine shrimp is discussed, as well as the community as a whole.
W81-02309

RELEASE OF PHOSPHORUS FROM LAKE SEDIMENTS,
National Inst. for Environmental Studies, Ibaraki (Japan). Lab. of Freshwater Environment.
M. Hosomi, M. Okada, and R. Sudo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173825, Price codes: A13 in paper copy, A01 in microfiche. In: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the Fifth United States-Japan Experts Meeting, Nov 1979, New Orleans, LA. Environmental Protection Agency Rpt EPA-600/9-80-044, Sep 1980, p115-127. 6 Fig, 2 Tab, 15 Ref.

Descriptors: *Lake Kasumigaura(Japan), *Lake sediments, *Eutrophication, *Phosphorus, Nutrients, Plant growth, Algae, Inorganic compounds, Lakes, Sediments, Aerobic conditions, Anaerobic conditions, *Japan.

The relationship between the content of various forms of phosphorus in lake sediments and the amount of phosphorus released under aerobic and anaerobic conditions was studied because of the role of phosphorus in the eutrophication process. The total phosphorus content in the sediment of Lake Kasumigaura, Japan, was highest (1.7 mg/g) in the 0-5 cm surface layer and decreased with depth to a constant (0.7 mg/g) at 15 cm. The decrease was consistent with a decrease in iron-bound phosphorus content (Fe-P). The amount of phosphorus released from the sediments was proportional to the decrease of Fe-P under both aerobic and anaerobic conditions. Under anaerobic conditions, 90% of the Fe-P initially contained in the sediments was released in 55 days. Using a dialysis apparatus, maximum growth yield of algae was shown to be linearly dependent on the amount of phosphorus released under aerobic conditions. (Brambley-SRC)
W81-02320

RELEASE, DISTRIBUTION, AND IMPACTS OF POLYCHLORINATED BIPHENYLS (PCB) INDUCED BY DREDGED MATERIAL DISPOSAL ACTIVITIES AT A DEEPWATER ESTUARINE SITE,
URS Co., Seattle, WA.
For primary bibliographic entry see Field 5B.
W81-02321

MATHEMATICAL MODEL OF PHOSPHORUS RELEASE FROM LAKE SEDIMENT,
Japan Bottom Sediments Management Association, Tokyo.
T. Yoshida, and T. Fukushima.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173825, Price codes: A13 in paper copy, A01 in michrofiche. In: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the Fifth United States-Japan Experts Meeting, Nov., 1979, New Orleans, LA, Environmental Protection Agency Report EPA-600/9-80-044, Sep., 1980, p 209-228. 18 Fig.

Descriptors: *Lake sediments, *Lake Nakanoumi(Japan), *Phosphorus, Eutrophication, *Mathematical models, Models, Lakes, Sediments, Water pollution effects, *Japan, Phosphorus release rates.

A study was conducted on the phosphorus release mechanism of lake sediment in a eutrophic area of Lake Nakanoumi, Japan. Sediment samples were used to examine the relationship between phosphorus content and sediment depth and to measure the amounts of phosphorus released. Release rates depended primarily on the phosphorus content of the sediment. The relationship between release rate and sediment depth is apparently parabolic. The partition coefficient for phosphorus is about 0.00001 1/day. The release rate curve becomes flat at sediment depths of about 20 cm. A mathematical model of phosphorus release rates was conceived and evaluated. The similarity and order of the various indices and curves implies that more attention should be paid to hydrostatic factors among the parameters affecting phosphorus release mechanisms. (Brambley-SRC)
W81-02323

FISH KILLS CAUSED BY POLLUTION IN 1977; EIGHTEENTH REPORT.
Environmental Protection Agency, Washington, DC. Office of Water Planning and Standards.
Report EPA-440/4-80-004, 1980. 73 p, 44 Fig, 8 Tab, 5 Append.

Descriptors: *Fishkill, *Water pollution effects, *Water pollution sources, Pesticides, Seasonal, Industrial wastes, Agricultural chemicals, Transportation, Endrin, Municipal wastes, Toxaphene, Cyanide.

This eighteenth annual report analyzes 503 fish kill reports made by 41 states. The remaining nine states reported no fish kills. A total of 16.5 million fish were reported killed in 449 of the 503 incidents. Most fish kills were small, killing fewer than 10,000 fish apiece, but two incidents accounted for 76% of the fish killed. Sources of pollution were identified for 383 of the reports. Municipal operations accounted for 21% of the incidents, agricultural operations and industrial operations 19% each, and transportation operations 9%. The summer months (May to September) accounted for 15 million fish deaths and 325 of the incidents occurred in these months. For the 50% of the reports giving information, the average duration was 2.5 days. The priority pollutants cyanide, endrin, and toxaphene killed more than 300,000 fish in twelve reported incidents. (Brambley-SRC)
W81-02327

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, SUMMARY REPORT, FINAL.
Frederiksen, Kamine and Associates, Inc., Sacramento, CA.
For primary bibliographic entry see Field 6G.
W81-02328

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, MAIN REPORT, FINAL.
Frederiksen, Kamine and Associates, Sacramento, CA.
For primary bibliographic entry see Field 6G.
W81-02329

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, APPENDIX A, SOCIOECONOMIC ANALYSIS, FINAL.
Frederiksen, Kamine and Associates, Sacramento, CA.
For primary bibliographic entry see Field 6G.
W81-02330

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, APPENDIX C, FISH AND WILDLIFE ANALYSIS, FINAL, VOLUME 1.
Frederiksen, Kamine and Associates, Sacramento, CA.
For primary bibliographic entry see Field 6G.
W81-02332

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANGEMENT PROGRAM, APPENDIX C, FISH AND WILDLIFE ANALYSIS, FINAL, VOLUME 2.
Frederiksen, Kamine and Associates, Sacramento, CA.
For primary bibliographic entry see Field 6G.
W81-02333

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, APPENDIX D, DRAFT REPORT COMMENTS AND RESPONSES, FINAL, VOLUME 1.
Frederiksen, Kamine and Associates, Sacramento, CA.
For primary bibliographic entry see Field 6G.
W81-02334

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, APPENDIX D, DRAFT REPORT COMMENTS AND RESPONSES, FINAL, VOLUME 2.
Frederiksen, Kamine and Associates, Sacramento, CA.
For primary bibliographic entry see Field 6G.
W81-02335

5D. Waste Treatment Processes

DESIGN AND ECONOMICS OF POWDERED ACTIVATED CARBON IN THE ACTIVATED SLUDGE PROCESS,
Engineering-Science Inc., Austin.
D. L. Ford, and W. W. Eckenfelder.
Progress in Water Technology, Vol 12, No 5, p 459-482, 1980. 14 Fig, 12 Tab, 25 Ref.

Descriptors: *Activated carbon, *Granules, *Activated sludge, Costs, Design criteria, Nitrification, Biochemical oxygen demand, Chemical wastes, Energy, Capital costs, Operating costs, Treatment facilities.

Recent progress in powdered activated carbon technology is reviewed, and energy demand capital and annualized cost information is presented. The applicability of activated carbon in removing organic and selected inorganic constituents can be tested using batch reactors in an isotherm approach. Following screening tests, bench scale reactors can be used to develop design criteria. Municipal waste water treatment plants using activated carbon have reported enhanced BOD removal, better control of effluent suspended solids, and improved nitrification. The chemical industry has

used the system to treat organic chemical wastes. A design of a powdered activated carbon system for a refinery is presented, and an overall costs model is derived. Energy is required for furnace usage as well as conveyance, unloading, slurry, and feed systems. The potential economic and process advantages of powdered activated carbon make it an attractive alternative treatment for wastes containing residual organic pollutants, many of which are suspected carcinogens, mutagens, or teratogens. (Small-FRC)
W81-02158

EXPERIENCE IN OPERATING THE DEEP SHAFT ACTIVATED SLUDGE PROCESS,
Anglian Water Authority (England). Essex Sewage Div.
O. C. Collins, and M. D. Elder.
Progress in Water Technology, Vol 12, No 5, p 671-684, 1980. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Activated sludge, *Treatment facilities, Domestic wastes, Municipal wastes, Organic matter, Settling basin, Performance, Deep Shaft, United Kingdom, Sewage treatment, Industrial wastes, *Thames River, *Waste water treatment.

The design, construction, and operating experience with a deep shaft activated sludge plant for the treatment of a mixture of domestic and industrial wastes is described. At the Marsh Farm plant in the United Kingdom, the 130 m deep, 1.86 m diameter shaft is divided into two concentric zones by an inner glass fiber tube. Crude sewage and returned activated sludge are lifted by screw pumps into the head tank for mixing before passage into the shaft for a retention time on the order of 1.5 hrs. Compressors introduce the air into both the riser and downcomer zones. Degassed mixed liquor is settled in a conventional clarifier. The dissolved oxygen level in the system is monitored continuously. Sewage analysis and sludge data are presented. The deep shaft system removed the high organic load and produced an effluent acceptable for discharge to the estuarial River Thames. There are some unsolved problems with degassing and settlement. (Small-FRC)
W81-02159

THE ACTIVATED SLUDGE PROCESS PART 2. APPLICATION OF THE GENERAL KINETIC MODEL TO THE CONTACT STABILIZATION PROCESS,
Scott and de Waal, Inc., Johannesburg (South Africa).
W. V. Alexander, G. A. Ekama, and G. v. R. Marais.
Water Research, Vol 14, No 12, p 1737-1747, December, 1980. 5 Fig, 2 Tab, 6 Ref.

Descriptors: *Mathematical models, *Activated sludge, Stabilization, *Municipal wastes, Kinetics, *Nitrification, Control, Cycles, Design, *Waste water treatment.

A general activated sludge model which includes nitrification for processes treating principally municipal waste water was applied to a contact stabilization process treating municipal waste waters. The model was changed to fit the new application. One of the values of the kinetic constants in the expressions of the substrate utilization rates was changed. Also, the enmeshment mechanism was altered by accepting that a fraction of the particulate COD which is not adsorbed onto the active organisms does not become enmeshed in the sludge flocs and escapes with the effluent. With these changes, the model was found to simulate the behavior of contact and stabilization reactors under constant and cyclic loading conditions. When the cyclic behavior of the process was investigated, it was found that peak flow periods reduce the carbonaceous material removal and nitrification efficiencies of the process in two ways. First, the actual hydraulic retention was reduced, and second, the sludge concentration in the contact reactor was reduced. This procedure can be useful for design engineers. (Small-FRC)
W81-02160

INTENSIFIED BIOLOGICAL WASTE WATER TREATMENT CITY OF FRANKFURT AM MAIN,
Technische Hochschule, Darmstadt (Germany, F. R.). Inst. fuer Wasserversorgung, Abwasserbeseitigung und Raumplanung
G. Rincke, and L. G. Gniosdorsch.
Progress in Water Technology, Vol 12, No 5, p 483-496, 1980. 8 Fig, 4 Tab, 7 Ref.

Descriptors: *Activated sludge, *Nitrification, *Treatment facilities, *Biological waste water treatment, Denitrification, Municipal wastes, Sludge treatment, Phosphorus, Bacteria, Lime, Water quality, *Frankfurt, Federal Republic of Germany, *Waste water treatment.

Intensified waste water treatment at the Frankfurt-Niederrad plant was developed, including studies of the sludge problem at the plant and consideration of phosphorus removal by the PHOSTRIP process. The treatment facilities consist of, in the second stage, aeration basin 1, settling basin 1, denitrification basin, aeration basin 2, and settling basin 2. The sludge is recycled, and part of the activated sludge waste water mixture is recycled directly from the effluent of the second activated basin. Reliable denitrification was found possible only in a separate stage in the presence of methanol. There was basically reliable nitrification even in cold weather. A sludge study is in progress which will examine the possibility of incineration without supplementary fuels by modifying various process techniques. Also, tests are being conducted on the feasibility of using the PHOSTRIP method of phosphate removal. Take up of phosphorus by bacteria is utilized via precipitation with lime. With these methods, the water quality of the heavily polluted Lower Main will be improved. (Small-FRC)
W81-02162

CONTROL OF NITRIFICATION IN THE OXYGEN ACTIVATED SLUDGE PROCESS,
Houston Univ., TX. Dept. of Civil and Environmental Engineering.
J. F. Andrews, P. E. Sorensen, and M. T. Garrett
Progress in Water Technology, Vol 12, No 5, p 497-519, 1980. 11 Fig, 15 Ref

Descriptors: *Control, *Activated sludge, *Nitrification, Oxygen, Ammonia, Computers, Treatment facilities, Municipal wastes, Equations, Performance, *Houston, Texas, *Waste water treatment.

A control strategy selected for a two step oxygen activated sludge process is expected to maintain the effluent ammonia concentration in the 2 to 4 mg/liter range. It is a feedforward strategy in which the influent ammonia concentration is measured by an online ammonia analyzer. A portion of the influent flow to the nitrification reactor is diverted to a fourth stage of this reactor so that the effluent ammonia concentration is in the desired range. A computer is used to solve material balance and control algorithm equations. The strategy was tested for approximately two weeks using the nitrification step of a two-step UNOX pilot plant installed at the Northside waste water treatment plant in Houston. Process control was performed by a Hewlett-Packard 9825 computer with real-time clock, floppy disc, and multiprogrammer for interfacing. An Ionics ammonia analyzer was used, and ammonia concentrations were measured and entered into the computer at two or four hour intervals. The strategy was viewed as successful, and expected annual savings of $250,000 per year were estimated for chlorine costs. (Small-FRC)
W81-02163

PERIODIC PARAMETER VARIATION IN A FULL SCALE TREATMENT PLANT WITH ALTERNATING OPERATION,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
J. L. C. Jansen, and J. C. Behrens.
Progress in Water Technology, Vol 12, No 5, p 521-532, 1980. 8 Fig, 2 Tab, 4 Ref.

Descriptors: *Biological treatment, *Nitrogen removal, *Treatment facilities, Design, Oxygen, Biochemical oxygen demand, Municipal wastes, Ammonia, Nitrogen, Alternating operation, Denmark, *Waste water treatment.

Biological nitrogen removal in a one sludge system using alternating operation is described, and results are presented for operation of a plant designed for a population of 33,000 people. Ninety percent nitrogen removal and 98% BOD removal was maintained using an alternating mode of operation. Key parameters for the design of nitrogen removal plants were determined using a 24-hour scale full-scale experiment and a mathematical model. The theoretical maximum ammonia removal rate was 1.0 mg NH4(+)-N/g VSS/h. In actuality, the rate is reduced by a Monod-type oxygen limitation with a half saturation constant equaling 2 mg of oxygen/liter. The maximum rate of nitrate removal was 7.8 mg NO3(-)-N/g VSS/h, and this rate had a logistic dependence on the oxygen concentration, resulting in a substantial nitrate removal up to 3 mg oxygen/liter in the reactor. (Small-FRC)
W81-02164

ODORS AND THEIR CONTROL IN SEWERS AND TREATMENT FACILITIES,
Los Angeles City Bureau of Sanitation, CA.
W. F. Garber.
Progress in Water Technology, Vol 12, No 5, p 657-664, 1980. 1 Fig, 4 Ref.

Descriptors: *Odor control, *Treatment facilities, *Sewers, Turbulence, Hydrogen sulfide, Incineration, Activated carbon.

The control of odors at treatment plants is reviewed. Odor at most treatment plants is due to the presence of hydrogen sulfide, solvents, acid fractions, or reductant fractions in the waste water. Long retention times in sewers can add to the problem. Low turbulence, high flows, and high oxygen contents in sewers can reduce odor production. In treatment plants, turbulence can be minimized except in cases of aerobic treatment. Odor treatment systems include ventilation systems which collect air for treatment, chemical treatment of the waste water, and the use of perfumes or masking agents. Treatment facilities include packed towers, biological reactors, incineration units, dispersion units such as high stacks, and activated carbon contact towers. In the City of Los Angeles, the general experience has been that odor treatment is difficult and expensive. Proper plant design and operation are preferred methods of avoiding the odor problem. (Small-FRC)
W81-02166

THAMES WATER AUTHORITY RIVERSIDE WASTE WATER TREATMENT WORKS - TRADE EFFLUENT TREATMENT PLANT OPERATING PROBLEMS AND THEIR RESOLUTION,
Thames Water Authority, London (England). Metropolitan Public Health Div
R. A. R. Drake, and P. A. Banks.
Progress in Water Technology, Vol 12, No 5, p 643-656, 1980. 2 Fig, 4 Tab, 2 Ref

Descriptors: *Industrial wastes, *Treatment facilities, Aeration, Settling basins, Activated sludge, Sprays, Hazards, Safety factors, United Kingdom, *Waste water treatment, *Thames Water Authority.

Pilot plant experimental work, the design of permanent units, and the mode of operation of industrial effluent treatment plants are described. The Riverside waste water treatment plant serves a population of 400,000. Twenty percent of its capacity is devoted to providing separate treatment for industrial wastes produced by a motor manufacturer and a pharmaceutical and agricultural products manufacturer. Pilot plant studies revealed that an aeration period of at least 12 hours was necessary to treat the industrial wastes. The final plant design included primary treatment consisting of grit removal and screening. There are three circular primary sedimentation tanks with a total capacity of 2850 cu m. Biological treatment is by the activated sludge process using Ames Crosta

Simplex surface aerators. Two final sedimentation tanks are provided. The plant was modified to reduce the speed of aeration and thus to decrease the production of a spray which was found irritating by plant operators. The industrial effluent contained manganese, toluene, and nitrobenzene. Nitrobenzene is known to cause contact dermatitis. The plant has operated successfully. (Small-FRC)
W81-02167

DEVELOPMENT TRENDS IN CONSTRUCTION AND CHEMICAL ENGINEERING OF BIOLOGICAL WASTE WATER TREATMENT PLANTS, TAKING HOECHSTAG AS AN EXAMPLE,
Hoechst A.G., Frankfurt-am-Main (Germany, F.R.).
A. Bauer.
Progress in Water Technology, Vol 12, No 5, p 665-670, 1980. 12 Fig, 4 Ref.

Descriptors: *Aeration, *Settling basins, *Biological waste water treatment, Treatment facilities, Performance, Odor, Design, Oxygen, Federal Republic of Germany, *Waste water treatment.

The design and operation of the Bio-Hochreaktor, a biological waste water treatment method, are described. The Bio-Hochreaktor includes a primary clarifier on top of an aeration basin. It can be used as a bubble column reactor, loop reactor, or a cascade operation. The system has been in parallel operation for 1-1/2 years, and is distinguished by a combination of high loading capacity and stable operations. The waste air problem is frequently solved with elaborate deodorization. This design follows the trend away from shallow basin and medium basin design to high level design. Even at loading rates of more than 3 kg per cu m per day, the operating performance of the Bio-Hochreaktor remains stable and produces effluent with desirable parameters. The primary advantages of the design are its smaller space requirement, improved oxygen utilization, and the fact that it can easily be covered if further odor treatment is required. (Small-FRC)
W81-02168

ODOURS EMITTED BY BASF AG'S ACTIVATED SLUDGE PLANT TREATING CHEMICAL WORKS EFFLUENT IN LUDWIGSHAFEN/RHINE,
BASF A.G., Ludwigshafen-am-Rhein (Germany, F.R.).
H. Engelhardt, W. G. Haltrich, and M. Wollnik.
Progress in Water Technology, Vol 12, No 5, p 621-631, 1980. 12 Fig, 2 Ref.

Descriptors: *Activated sludge, *Chemical wastes, *Odor control, Settling basins, Control, Incineration, Aeration lagoons, Equipment, Covers, *Federal Republic of Germany, Ludwigshafen-Rhine.

After startup of an activated sludge treatment plant in Ludwigshafen/Rhine for the treatment of chemical industry wastes, many complaints of odors were made by residents from a nearby town. As many as 68 complaints were received in one 20 day period. The plant consisted of a grid chamber and water splitting facility, a primary clarifier, a water splitting facility, an aeration basin, a secondary clarifier, a sludge thickener, and a high water pumping station. The pathway of the odor and the odor threshold values were determined for the plant. Thirty of the 280 production plants at the Ludwigshafen works were found to be significant sources of odor. Odor was reduced by flooding the sedimentation basins to avoid de-gassing of low-boiling substances at the overflow. Distributor, junction facilities and manholes were made gas-proof by covering them. The waste air from the sludge conditioning facility is now incinerated. Aeration basins were covered, which reduced their emissions by about 7%. The covers cost about 10 million DM. It is expected that when all odor reduction methods have been implementd, the inhabitants of nearby towns will not be troubled by sewage plant odor. (Small-FRC)
W81-02169

ON THE REDUCTION OF ODOUR EMISSIONS BY COVERING SURFACE AERATION TANKS,
Emschergenossenschaft, Essen (Germany, F.R.).
S. Schlegel.
Progress in Water Technology, Vol 12, No 5, p 633-642, 1980. 6 Fig.

Descriptors: *Odor control, *Aeration, Treatment facilities, Air pollution, Oxygen, Environmental engineering, *Germany, Covered tanks.

Odor emissions from aeration tanks can be reduced by covering the tanks, although additional treatment of the contaminated air may be required. Tests were performed to obtain dimensioning data for the covering of surface aeration tanks and to determine how high the reduction in odor emissions can be. Two pilot plants operated in parallel were covered and charged with different air throughput quantities. An equation was derived to estimate odor reduction. A considerable reduction was possible, depending upon the oxygen content in the tank gas space. One covered tank supplied with pure oxygen had very low amounts of waste air. Using pure oxygen, the gas exchange rates and odor emissions were decreased by more than 99%. Pure oxygen is needed in the first part of the aeration tank, where oxygen demand and emissions are extremely high. (Small-FRC)
W81-02173

ODOUR CONTROL WITH HYDROGEN PEROXIDE,
Interox Chemicals Ltd., Widnes (England).
A. F. E. Sims.
Progress in Water Technology, Vol 12, No 5, p 609-620, 1980. 2 Fig, 1 Tab.

Descriptors: *Odor control, *Sulfides, Oxidation, Sewerage, *Sludge treatment, Waste water treatment, Chemistry, *Hydrogen peroxide, United Kingdom.

The advantages of hydrogen peroxide control of odor are discussed, and the principles and practices involved in evaluating and implementing hydrogen peroxide odor control systems are described. Advantages of hydrogen peroxide include the fact that it is an inexpensive, stable, non-corrosive liquid. The absence of solubility limitations enables the efficient tratment of high pollutant concentrations at atmospheric pressure. It provides for rapid oxidation of a variety of sulphur containing products and for highly selective oxidation of pollutants by choice of conditions. The chemistry of hydrogen peroxide is outlined. Steps involved in estimating hydrogen peroxide usage for rising main treatment include establishment of such parameters as main dimensions, average sewage residence, daily flow rate, and pump rates. The sulfide level to be treated must be established. Hydrogen peroxide can also be used for the treatment of sulfides in sludge, odor control in industrial waste water, and gas scrubbing to prevent air pollution. Hydrogen peroxide makes possible a versatile and flexible treatment system. (Small-FRC)
W81-02174

THE DESIGN OF TWO PLANTS FOR BIOLOGICAL REMOVAL OF NUTRIENTS,
Meiring (P. G. J.) and Partners, Inc., Johannesburg (South Africa).
J. L. Barnard, and P. J. Pybus.
Progress in Water Technology, Vol 12, No 5, p 593-598, 1980. 4 Fig, 1 Tab, 1 Ref.

Descriptors: *Nutrients, *Biological treatment, *Nutrient removal, *Activated sludge, Phosphorus, Nitrogen, Nitrates, Anaerobic digestion, Aeration, Fermentation, Treatment facilities, South Africa.

Two activated sludge units were designed as extensions to biological filter plants to provide additional treatment capacity for a total contributing population of 58,000 persons. The basic process at both plants consisted of fermentation basins, first anoxic basins, aeration basins, second anoxic basins, re-aeration basins, and clarifiers. Adjustable flow valves were used at both plants to admit the flow to the activated sludge plant at a near constant rate. At one plant, the activated sludge plant was commissioned on February 1, 1979, and within two weeks was producing an effluent that met standards. A sample exhibited a COD of 24 mg/liter, phosphate content of 3.0 mg/liter, nitrogen content of 1 mg/liter, and nitrate of 1.9 mg/liter. Improved results are expected after longer operation. One plant experienced problems because of a fixed outlet weir on the surface aerators. An adjustable weir at the second plant provided more control. Plant effluent meets standards with only biological treatment. (Small-FRC)
W81-02175

HYDRAULIC LOSSES IN BIOLOGICAL REACTORS WITH CIRCULATING FLOWS,
Tahal Consulting Engineers, Ltd., Tel Aviv (Israel).
M. Goldstein.
Progress in Water Technology, Vol 12, No 5, p 565-592, 1980. 9 Fig, 6 Tab, 8 Ref.

Descriptors: *Head loss, *Rotational flow, *Aeration, Rotors, Equipment, Design, Equations, Baffles, *Biological treatment, *Israel.

Calculation of hydraulic losses along one complete circuit of a rotating biological reactor was necessary to design a plant with the optimum distribution of operating rotors to meet aeration requirements. Data in the literature were used. Evaluation of head loss coefficients was based on measured flows and gross power inputs for Wulkatal Regional Plant, underflow measurements for slightly immersed gates, and classic hydraulic formulae. The coefficients were checked by applying them to the calculation of flows and gross power inputs for three plants. Results indicated that the coefficients could be used for design purposes within the usual ranges of power densities and flow velocities. Hydraulic losses are caused primarily by the hydraulic resistance of baffles and guiding walls, and a special formula was developed for this. The calculated head lift per rotor was in the range of 0.5 cm to 1.5 cm, depending upon submergence. The hydraulic efficiency of the rotor was very small. A sample calculation is presented for a reactor with a volume of 1200 cu m equipped with four rotors of 4.5 m length each. (Small-FRC)
W81-02176

THE NEW INDUSTRIAL WASTE WATER TREATMENT PLANT AT THE CHEMICAL WORKS OF DSM (NETHERLANDS): DESIGN AND PRACTICAL EXPERIENCE,
DSM's Central Lab., Geleen (Netherlands). Environmental Research Dept.
V. E. A. Baenens.
Progress in Water Technology, Vol 12, No 5, p 599-608, 1980. 4 Fig, 2 Tab, 2 Ref.

Descriptors: *Chemical wastes, *Nitrogen, *Biological treatment, Denitrification, Nitrification, Sludge treatment, Chemical industry, Treatment facilities, Design, Performance, *Netherlands, *Waste water treatment.

A new biological treatment plant designed to remove nitrogen from waste water from an extensive chemical industry plant complex is described. The process scheme includes denitrification, nitrification, biological oxidation, second denitrification, and sludge processing. It was necessary to add BOD to the waste water to effect complete nitrate removal by denitrification. Prior to the designing and construction of the facility, laboratory experiments were carried out, and the sludge load, minimum water temperature, and maximum BOD sludge load were calculated. The initial practical experience was gained using a pilot plant and observing a domestic sewage plant. The new plant was built, and it incorporates three identical streams that are arranged in parallel. Thus, in case of a calamity, it is possible to buffer the water in separate buffer tanks, or the entire waste stream can pass through only one of the streams. This prevents the release of toxins into the river and protects downstream drinking water sources. (Small-FRC)

W81-02177

DISPOSAL OF SECONDARY SLUDGE IN THE KRAFT RECOVERY SYSTEM,
Institute of Paper Chemistry, Appleton, WI.
For primary bibliographic entry see Field 5E.
W81-02178

CHLORINE DYNAMICS DURING INACTIVATION OF COLIFORMS, ACID-FAST BACTERIA AND YEASTS,
Rensselaer Polytechnic Inst., Troy, NY.
C. N. Haas, and R. S. Engelbrecht.
Water Research, Vol 14, No 12, p 1749-1757, December, 1980. 7 Fig, 1 Tab, 26 Ref.

Descriptors: *Chlorine, *Permeability, *Coliforms, Yeasts, Bacteria, Hydrogen ion concentration, Water purification, Waste water treatment, *Water treatment.

A study which extended the permeability theory of chlorine action to vegetative microorganisms is described. Chang (1944) and others developed the theory with other microorganisms. To determine the mode of action of free chlorine in inactivating coliforms, acid-fast bacteria, and yeasts, the uptake of radioactive chlorine was determined. Cell-associated chlorine can be modelled by the Freundlich relationship, with either free available chlorine or hypochlorous acid as an independent variable. At a pH of 7.0, Candida parapsilosis and Mycobacterium fortuitum exhibited greater uptake of chlorine than at a pH of 9.14. The effect of pH on E. coli was just the opposite, probably due to losses in cellular material. The results with E. coli confirmed Frieberg's results (1956, 1957) which seem in conflict with the permeability theory. However, the increased efficiency of chlorine at low pH's may prompt extensive loss of cell material including associated chlorine. (Small-FRC)
W81-02186

COMPONENT MIX MEETS TOUGH STANDARDS,
N. A. Van Dyke.
Water and Wastes Engineering, Vol 17, No 11, p 36-39, November, 1980. 1 Fig, 5 Tab.

Descriptors: *Treatment facility, *Food processing industry, *Activated sludge, Flotation, Oxidation, Biological treatment, Tertiary treatment, Oils, Costs, Meat packing plant, Rendering plant, *Waste treatment.

A combination of dissolved air flotation, modified activated sludge, and biooxidation tower components was used to meet discharge permit requirements at a meat packing and rendering operation. The rendering wastes had a BOD of up to 10,000 mg/liter, extremely high amounts of oil and fats, and a temperature range up to 185 deg F. The plant was designed to treat 10,770 lbs BOD/day. Dissolved air flotation units were used for by-product recovery and for the removal of oil and grease. The bio-oxidation tower was used to pretreat the high strength, high temperature rendering wastes and helped provide teritary treatment at secondary treatment costs. Construction costs were reduced by building the aeration basin with lightly reinforced sloped slab-on-grade construction. Additional BOD and suspended solids removal was obtained through a manmade marsh system which provided a buffering zone before stream discharge. The project was constructed for $950,000. The bio-oxidation tower saved approximately 200 horsepower compared to blowers. This resulted in an annual energy savings of $31,000. (Small-FRC)
W81-02187

WINNING DESIGN SATISFIES DIVERSE NEEDS,
J. H. Jenks, and B. M. Wyckoff.
Water and Wastes Engineering, Vol 17, No 11, p 16-18, 20, 21, November, 1980. 3 Fig, 4 Tab.

Descriptors: *Treatment facilities, *Municipal wastes, *Architecture, Design, Buildings, Odor control, Environmental engineering, *Waste water treatment, *California, San Mateo.

A two mgd, 45-year-old primary waste water treatment plant was economically transformed into a 13.6 mgd plant which meets teritary treatment standards. The San Mateo, California, plant had been enlarged three times for expanded primary treatment and was quite extensive. The most recent expansion included covering the existing and new primary clarifiers and sludge thickeners with domes, installing high capacity ventilation systems with air scrubbers, and housing sludge dewatering facilities including new vacuum filters in an area furthest away from housing and a school. All air from the buildings was introduced into the combustion air system of the solids incinerator, low noise level centrifugal blowers were used to supply air to aeration tanks, and all noise producing equipment was housed in sound-damping buildings. The plant site was surrounded with attractive fencing and landscaped. Odor control programs included prechlorination as a backup. While the old plant's public image had ben poor, the new plant was favorably accepted by the community and handled wet-weather flows. (Small-FRC)
W81-02188

FLEXIBLE SYSTEM SAVES ENERGY,
J. A. Gennrich, and M. M. Gipps.
Water and Wastes Engineering, Vol 17, No 11, p 40-43, November, 1980. 1 Fig, 5 Tab.

Descriptors: *Treatment facilites, *Canneries, *Flexibility, Municipal wastes, Industrial wastes, Trickling filters, Aeration, Non-uniform flow, Biochemical oxygen demand, *California, Settling basins, *Waste water treatment, Atwater(CA).

The waste water treatment plant at Atwater, California, was expanded to meet extreme hydraulic and organic variations. The plant provides treatment services to a population of 15,000 and a cannery. Because treatment requirements varied considerably, due in part to the cannery operating schedule, the plant was expanded to include five possible treatment modes. These were: Primary clarifier-trickling filter-final clarifier, Primary clarifier-extended aeration basin-final clarifier, Primary clarifier-trickling filter-secondary clarifier-extended aeration basin-final clarifiers for domestic flow and extended aeration basins-final clarifiers for industrial flow, and Primary clarifier with secondary clarifier used as a primary clarifier-trickling filter-extended aeration basins-final clarifiers. The mode selection is determined by the frequency and organic character of the influent industrial BOD load. Maximum design loading when all unit processes are operating is 37,000 lb/day. The expansion of the plant cost 4.6 million dollars. Currently, BOD is averaging 10 mg/liter and suspended solids is 19 mg/liter. (Small-FRC)
W81-02189

TRACE ORGANIC BEHAVIOR IN SOIL COLUMNS DURING RAPID INFILTRATION OF SECONDARY WASTE WATER,
Stanford Univ., CA. Dept. of Civil Engineering.
E. J. Bouwer, P. L. McCarty, and J. C. Lance.
Water Research, Vol 15, No 1, p 151-159, January, 1981. 8 Fig, 2 Tab, 28 Ref.

Descriptors: *Waste water treatment, *Sorption, *Infiltration, *Ultimate disposal, *Organic compounds, Halogenated compounds, *Phoenix, Arizona, Disposal, Volatility, Biodegradation.

Removal of trace organic compounds from effluent was studied by applying tap water and secondary waste water from the City of Phoenix to soil columns at infiltration rates typical of high-rate land application (24-40 cm per day for waste water and 50 cm per day for tap water). Infiltration rates did not affect the degree of organic removals. The waste water contained chloroform, 1,1,1-trichloroethan, and tetrachloroethylene in the range of 1-10 micrograms per liter. The tap water contained 50 micrograms per liter chloroform and some different halogenated compounds. Breakthrough of chloroform occurred, but the other organic compounds were significantly removed. Compounds present in concentrations up to 1 microgram per liter which were identified in the influents and effluents included hydrocarbons, alcohols, ketones, aromatics, phthalates, chlorianted anisoles, pesticides, and unknown compounds. Some materials present in the effluents were not detected in the influent waste water. This may be a result of the soil colums having been previously used for similar studies. It is believed that bacterial secondary metabolism was probably responsible for organic removal, as well as sorption and volatilization. (Cassar-FRC)
W81-02190

NONLINEAR MODELS OF BIOLOGICAL TREATMENT PROCESSES,
Adademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. A. Vavilin, and V. B. Vasiliev.
Ecological Modelling, Vol 9, p 57-71, February, 1980. 5 Fig, 18 Ref.

Descriptors: *Mathematical models, *Biological treatment, *Activated sludge, *Algae, Nutrients, Diffusion, Nonlinear models, Sewage treatment, *Waste water treatment.

Nonlinear models for the processes of biochemical oxidation of organic substances in activated sludge systems and for the removal of nutrients by algae in biological ponds are described. Monod's model is described; this entails a simple relationship and is often used in the cultivation of microorganisms. This simple nonlinear model can be derived from a consideration of kinetic transformations of the substrate in a cell. For activated sludge particles, it is necessary to consider the diffusion mechanism by which the substrate penetrates such particles. Models discussed include the steady-state diffusion model (Lee and Takamatsu, 1976) and Haldane's model. Nonlinear models can be adapted to allow the description of dynamic systems which have certain equilibrium states. Models should be sufficiently accurate within the range of variations determined by the conditions of application, and they should be as simple as possible. (Small-FRC)
W81-02196

REDUCED-ORDER MODELLING OF THE ACTIVATED-SLUDGE PROCESS,
Florence Univ. (Italy).
S. Marsili-Libelli.
Ecological Modelling, Vol 9, p 15-32, February, 1980. 8 Fig, 23 Ref.

Descriptors: *Mathematical models, *Activated sludge, *Predation, *Waste water treatment, Microorganisms, Statistical analysis, Computers, Control, Management, Italy.

A model for the activated sludge process is proposed, which considers the substrate-bacteria interaction as a prey-predator pair. The Volterra-Leslie equations (Maynard Smith, 1974) are used. The structural determination of this second order model is described. In calibration of the model, special emphasis was placed on field-data pretreatment. Power spectrum analysis was examined as a possible means of providing a guideline for smoothing. After calibration and validation, the sensitivity analysis showed that the model does not possess any critical parameter. This simpler structure model was compared with more complex models; the simpler model caused no major loss of accuracy. The model has several useful applications. It can be used on a small process computer as a state observer. It could help in plant control and management applications. Presently, the incorporation of dynamics for dissolved oxygen is being studied. (Small-FRC)
W81-02197

BEHAVIOR OF RADIUM AND BARIUM IN A SYSTEM INCLUDING URANIUM MINE WASTE WATERS AND ADJACENT SURFACE WATERS,
Technical Univ. of Prague (Czechoslovakia). Dept. of Nuclear Chemistry.
For primary bibliographic entry see Field 5B.

W81-02200

THE TREATMENT OF MIXED INDUSTRIAL AND DOMESTIC SEWAGE USING CHEMICAL AND BIOLOGICAL TREATMENT AT DAVY-HULME ADVANCED WASTE WATER TREATMENT PILOT PLANT,
Department of the Environment, London (England).
J. L. Vosser.
Progress in Water Technology, Vol 12, No 5, p 395-410, 1980. 4 Fig, 10 Tab.

Descriptors: *Activated sludge, *Chemical precipitation, *Industrial wastes, Domestic wastes, Municipal wastes, Activated carbon, Lime, Coagulation, Filtration, Treatment facilities, Performance, United Kingdom, *Waste water treatment, Manchester.

Chemical precipitation followed by activated sludge treatment and final adsorption with activated carbon was used to treat sewage containing a high proportion of industrial wastes. Sedimentation efficiency was evaluated using lime alone and using lime and aluminum sulfate. Results with lime alone were better or at least as good and were less expensive. Sedimentation periods of one hour or more resulted in 80% removal of suspended solids. High rate activated sludge treatment of the settled sewage produced an effluent which consistently had a maximum suspended solids level of 20 mg/liter and a biochemical oxygen demand of 20 mg/liter. Peak loadings were not a problem. The addition of aluminum as a coagulant aid virtually eliminated the scaling problems caused by lime. Effluent quality was improved further by dual media filtration and activated carbon treatment. Salmonellae were removed completely from the sewage through the use of lime. (Small-FRC)
W81-02203

TREATMENT OF COMBINED DOMESTIC AND INDUSTRIAL WASTE WATER IN GARLAND, TEXAS,
Texas Univ. at Dallas, Richardson.
A. Netzer, J. McNutt, and W. B. Dollar.
Progress in Water Technology, Vol 12, No 5, p 427-431, 1980. 1 Tab, 3 Ref.

Descriptors: *Treatment facilities, *Industrial wastes, *Municipal wastes, Sludge disposal, Biological treatment, Filtration, Carbon adsorption, Coagulation, Chlorination, Combined municipal and industrial wastes, Texas, *Waste water treatment, Garland.

The Duck Creek Waste water Treatment Plant in Garland, Texas, treats sewage from a city of 145,000 and industrial discharges from 265 light industries. The facility was recently expanded into a 22.5 MGD physical-chemical process in addition to the orginal 10 MGD biological process. The physical-chemical configuration consists of equalization, chemical coagulation, flocculation, precipitation, recarbonation, filtration, activated carbon adsorption, and disinfection. The biological treatment process consists of screening and degritting equipment, primary clarifier, trickling filters, and final clarifier. Carbon adsorption, disinfection, sludge dewatering, and scum disposal are combined for both processes. Sludge disposal is at a sanitary landfill. The city has experienced rapid growth, but the treatment needs have been met with this combined system. The new facility is both economically feasible and environmentally sound. (Small-FRC)
W81-02204

EFFICIENCY AND RATE OF ELIMINATION OF POLYCHLORINATD BIPHENYLS FROM WASTE WATERS BY MEANS OF ALGAE,
Ceskoslovenska Akademie Ved, Trebon. Lab. of Biotechnology.
K. Veber, J. Zahradnik, and I. Breyl.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 6, p 841-845, December, 1980. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Polychlorinated biphenyls, *Waste water treatment, *Algae, *Absorption, Phytoplankton, Municipal wastes, Farm wastes, Pollutants, Scenedesmus acutus, Chlamydomonas geitleri.

Polychlorinated biphenyls (PCB) were eliminated from municipal waste water and piggery waste water at efficiencies of up to 100% by algal concentration and subsequent lyophilization. Scenedesmus acutus was cultivated outdoors in southern Bohemia for 2-week periods during June-September, 1978, at average daily temperatures of 19.8C. Once a day a volume of the suspension was withdrawn and replaced by the same volume of waste water. Dilution rates and corresponding elimination efficiencies were as follows: 0.1, 100%; 0.2, 67%; 0.3, 80%; and 0.5, 45%. Similar studies done with Chlamydomonas geitleri at an average temperature of 17.8C in May and June 1979 showed 0.1, 84%; 0.2, 73%; 0.3, 64%; and 0.5, 100%. Although there was a trend toward decreasing efficiency of PCB absorption with increasing dilution rate, weather may also have been a factor. The PCB contents of the dry algal biomass at the maximum dilution rate were 213 mg per kg for S. acutus and 157 mg per kg for C. geitleri. (Cassar-FRC)
W81-02227

THE OXYGEN DEMAND OF SEWAGE,
T. Stones.
Effluent and Water Treatment Journal, Vol 20, No 9, p 437-440, September, 1980. 6 Tab, 20 Ref.

Descriptors: *Sewage treatment, *Oxygen demand, *Chemical oxygen demand, *Waste water treatment, Water quality control, Sewage, Sewage disposal, Water pollution treatment, Oxidation.

The oxygen demand of sewage is used as a basis for determining the concentration of oxidizable matter present in it, and therefore reflects its polluting character. This oxygen demand can also be used for assessing the loading and performance of sewage treatment plants. The complete biochemical oxidation of sewage occurs in two distinct stages. The first stage is oxidation of carbonaceous matter, and the second is oxidation of ammonia present from the beginning. Any practical method of providing an accurate measure of the carbonaceous oxygen demand of sewage must depend on the expeditious and complete oxidation of the carbonaceous matter. The recently developed chemical oxygen demand (COD) test, in which the amount of oxygen consumed from silver catalyzed dichromate is measured by the Dobbs and Williams modification, is such a method. Using the reduction in the total oxygen demand as an absolute measure of the purification effected during treatment, an assessment was made on the performance of a biological filtration plant and an activated sludge plant. The observed reduction in biochemical oxygen demand suggests that the activated sludge plant is giving a better performance than the filter plant. However, the reduction in total oxygen demand shows the filter plant to be far superior, due mainly to far better reductions in the nitrogenous oxygen demand due to nitrification as well as to a significantly better reduction in total carbonaceous oxygen demand. (Baker-FRC)
W81-02237

THE TERTIARY TREATMENT OF SEWAGES,
Loughborough Univ. of Technology (England).
K. V. Ellis.
Effluent and Water Treatment Journal, Vol 20, No 9, p 422-423, 425-428, 430, September, 1980. 27 Ref.

Descriptors: *Waste water treatment, *Sewage treatment, *Tertiary treatment, Filtration, Water pollution treatment, Sewage, Sewage disposal, Luton, *England.

Tertiary treatment usually refers to processes that primarily reduce the suspended solids content of a secondary effluent and, at the same time, reduce the level of the BOD. In general such treatment includes the use of microstrainers, grass plots, lagoons, sand filtration (slow, rapid gravity, and upward flow filtration), upward flow clarifiers and nitrifying filters. Grass plots are a simple and effective means of upgrading a poor effluent and consist basically of gently sloping areas of land covered either with specially sown, deep-rooted grasses or with natural flora. Slow sand filters are employed as three layers with the under drainage constructed of split tiles, open-jointed pipes or perforated unglazed pipes, laid with a slight fall toward a manifold. On top of these underdrains are layers of coarser media, on top of which is a sand layer. Rapid sand filters, while similar, employ coarser media, allowing the suspended matter to pass deeply into the bed before it is removed. The dual-media filter was developed to allow coarser, suspended solids in the filter feed to be removed in the coarser grains of the upper medium, allowing finer suspended solids to pass to the deeper sand mass before being removed. In the upward-flow filter the coarsest layer is at the bottom and the finest at the top, and the water filters from bottom to top. The use of backwashing to clean filters is also discussed. (Baker-FRC)
W81-02238

15 YEARS PRACTICAL EXPERIENCE WITH DISSOLVED AIR FLOTATION (DAF),
Purac A. B., Lund (Sweden).
B. Rosen.
Water Services, Vol 84, No 1015, p 526-527, September, 1980. 3 Fig.

Descriptors: *Flotation, *Waste water treatment, *Tertiary treatment, Water pollution treatment, Sewage, Foaming, Sewage treatment.

Dissolved air flotation systems are designed for chemical treatment of surface waters for potable use as well as for advanced tertiary treatment of waste water. Hundreds of flotation plants are in operation, with capacities up to 16000 cubic meters per hour. Flotation involves the generation of extremely small bubbles, which attach to the solids to be separated, causing them to rise rapidly. The bubbles should have a diameter of 30-80 microns. The technique for generating these bubbles depends on controlled liberation of dissolved air. The aggregates rise to the water surface, forming a stable sludge blanket suspended above the water surface by the bubbles. The water is then drained downwards from the sludge. An example is given of removing algae by flotation in a potable water treatment plant, using water from the Ruhr river. Flotation is also used in the treatment of industrial and municipal waste waters and sewage, and for the separation and recovery of fibers. (Baker-FRC)
W81-02255

EVALUATION OF TREATMENT TECHNOLOGIES FOR WATER REUSE IN COAL GASIFICATION,
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
R. G. Luthy, J. R. Campbell, L. McLaughlin, and R. W. Walters.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182164, Price codes: A12 in paper copy, A01 in microfiche. Office of Water Research and Technology Report OWRT/RU-80/9, July, 1980. 248 p, 52 Fig, 40 Tab, 153 Ref, 18 Append. OWRT-C-80232-R(No 8815)(1), 14-34-0001-8815.

Descriptors: *Coal gasification, *Water reuse, *Waste water treatment, Industrial wastes, Waste disposal, Activated sludge, Coal conversion processes, Economic feasibility, Synthetic fuels.

This investigation assessed significant issues and conducted bench scale experiments pertinent to management and reuse of coal coking and coal gasification process waste waters. For the case of high-BTU coal gasification processes, the cooling tower is the most likely target for reuse of process waste water. Treatment studies were performed with high BTU pilot coal gasification process quench waters to evaluate enhanced organic removal via powdered activated carbon-activated sludge treatment, and to evaluate a coal gasification waste water treatment train comprised of sequential processing via ammonia removal, biological oxidation, lime-soda softening, granular activat-

ed carbon adsorption and reverse osmosis. Biological oxidation of coal gasification waste water showed excellent removal efficiencies at moderate loadings; addition of powdered activated carbon provided lower effluent COD and color. Gasification process waste water treated through activated carbon adsorption appears suitable for reuse as cooling tower make-up water. Screening studies indicate that reverse osmosis is an attractive technique for reducing waste water dissolved solids. Additional study is needed to determine quality constraints regarding acceptable waste water organic loading in cooling tower make-up water, and to evaluate possible release of toxic/hazardous organics to the environment via cooling tower drift. Additional follow-up work to this study is in progress to evaluate solvent extraction of gasification process waste waters to recover phenolics and to reduce priority organic pollutants.
W81-02262

ADVANCED TREATMENT OF ALUMINUM INDUSTRY EFFLUENT FOR NON-POTABLE REUSE,
Rexnord Inc., Milwaukee, WI. Environmental Research Center.
R. A. Osantowski, A. Geinopolos, J. E. Kane, and G. Rollinger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182289. Price codes: A08 in paper copy, A01 in microfiche. Office of Water Research and Technology Report OWRT/RU-80/15, January, 1981. 137 p, 17 Fig, 31 Tab, 12 Ref, Append. OWRT-C-90084-R(No 7805)(1), 14-34-0001-7805.

Descriptors: *Reverse osmosis, *Electrodialysis, *Demineralization, *Recycling, *Industrial wastes, Filtration, *Aluminum industry, Membrane life, *Non-potable reuse, Waste water renovation, Chemical flocculation/clarification.

This report presents the findings of a six month pilot plant study investigating non-potable reuse of aluminum plant waste water. The two demineralizing technolgies studied were reverse osmosis and electrodialysis. Pretreatment throughout the testing consisted of chemical flocculation/clarification and multimedia filtration. During the investigation, over 3,000 operating hours were put on each of the two desalting technology membranes to obtain information on membrane life expectancy. The most promising treatment technologies tested which meet the various non-potable reuse needs of the aluminum industry were determined by pilot plant performance. Potential water reuse applications were identified along with water quality and quantity requirements. Comparisons were made to the treated effluent quality achieved from each of the pilot process elements.
W81-02263

MAGNESIUM COAGULATION OF OXIDATION POND EFFLUENT,
Auburn Univ., AL. Dept. of Civil Engineering.
J. M. Morgan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182198. Price codes: A04 in paper copy, A01 in microfiche. Completion Report, December, 1980. 44 p, 13 Fig, 5 Tab, 27 Ref. OWRT-A-065-ALA(2), 14-34-0001-8001.

Descriptors: *Coagulation, *Flocculation, *Sedimentation, *Magnesium, *Algae control, *Oxidation ponds, Waste water treatment, Effluents, Laboratory tests, Evaluation.

A jar test procedure was utilized to investigate the effectiveness of magnesium for the removal of algae from aqueous suspension by a coagulation, flocculation and sedimentation process. Magnesium was shown to be an effective coagulant for laboratory grown cultures of Chlorella and Chlamydomonas as well as effluent from an operating municipal oxidation pond. The mechanism of coagulation was shown to be a combination of specific chemical interaction between algal cells and positively charged magnesium hydroxide floc and enmeshment in the hydroxide precipitate. The overall process was stoichiometric with the required magnesium dosage being dependent upon the inital volatile suspended solids concentration at all pH levels investigated.
W81-02267

LONG-TERM EFFECTS OF CHROMIUM AND COPPER ON THE ROTATING BIOLOGICAL CONTACTOR,
Oklahoma State Univ., Stillwater.
A. Keihani.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182172. Price codes: A04 in paper copy, A01 in microfiche. MS Thesis, July, 1980. 51 p, 18 Fig, 18 Tab, 11 Ref. OWRT-A-087-OKLA(2), 14-34-0001-9038.

Descriptors: *Waste water treatment, Biological contactor, Heavy metals, Effluent, *Chromium, *Copper, Biological oxygen demand, Chemical oxygen demand, Organic carbon, Testing procedures, Evaluation.

This laboratory investigation studied the long-term effect of hexavalent chromium and divalent copper. Different concentrations of chromium (1mg/l, 5mg/l, and 10mg/l) and copper (3mg/l and 10mg/l) were used at each concentration. COD, TOC, and BOD tests were run. During each day these tests were run, the amount of these metallic ions was measured in the influent and effluent. This investigation found that the effect of chromium is not a function of time, and the results of the first and last day are the same. However, 10mg/l chromium concentration did upset the system, but chromium removal was as high as 1mg/l and 5mg/l. This investigation also found that the effect of copper on rotating biological contactors is not a function of time. Although a high copper removal was obtained, 10mg/l copper concentration deteriorated the systm completely, and the sludge was black during the period of analysis for this concentration.
W81-02269

LEACHATE QUALITY FROM LYSIMETERS TREATING DOMESTIC SEWAGE,
Hawaii Univ., Honolulu. Water Resources Research Center.
G. T. Tasato, and G. L. Dugan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182248. Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 131, April, 1980. 86 p, 13 Fig, 26 Tab. OWRT-A-069-HI(2), 14-34-0001-7025, 8013.

Descriptors: *Sewage disposal, *Sewage treatment, *Lysimeter, *Waste water treatment, *Domestic wastes, Soil treatment, Cesspools, *Hawaii, *Oxisol, *Inceptisols, *Entisols, Wahiawa series, Lahaina series, Tantalus series, Jaucas series, Oahu.

A study was undertaken to determine the treatability of raw domestic wastes using waste water treatment lysimeters. A pilot treatment unit was constructed that included four waste water treatment lysimeters, each utilizing a different Hawaiian soil. The soils included two silty clays of the Wahiawa and Lahaina series, a silty loam of the Tantalus series, and a beach sand of the Jaucas series. The use of graded rocks or gravel was incorporated in all of the soil series with the exception of the Wahiawa series. The Wahiawa and Lahaina soil lysimeters employed a top surface application scheme while the Tantalus and Jaucas lysimeters utilized a lateral flow scheme. Two residential cottages served as the domestic waste water source and produced flows ranging from 3.15 to 5.04 x 10 super 6 m super 3/s (72-115 gpd). In general, the Tantalus and Jaucas series attained relatively higher removal efficiencies than the Wahiawa and Lahaina series. However, in all of the soil series, only moderate constituent removals were observed particularly for dissolved solids, organics, ammonia nitrogen,and bacteria. The only constituents which showed high removals were suspended solids and phosphorus. The primary factor for the low overall removals was probably overloading of the lysimeters inasmuch as both the hydraulic and constituent loadings (especially organics, solids, nitrogen, and bacteria) proved to be excessive. Soil clogging was also evident to some extent in all of the soil series.
W81-02275

5E. Ultimate Disposal Of Wastes

TRENDS IN LIQUID SLUDGE MANAGEMENT IN THE NIERS REGION,
Niersverband, Viersen (Germany, F.R.).
G. Kugel.
Progress in Water Technology, Vol 12, No 5, p 685-691, 1980. 1 Fig, 2 Tab, 5 Ref

Descriptors: *Sludge treatment, *Sludge disposal, *Soil disposal fields, Heavy metals, Copper, Transportation, Arable land, Pastures, Pasteurization, Niers River, Federal Republic of Germany.

Recycling liquid sludge to land is part of the Niers river basin management system of the Niersverband, West Germany. Thickened and mostly anaerobically stabilized sludge, about 450,000 cu m/year, is applied to land at an application rate of 100 cu m/ha. The sludge is collected from 30 sewage treatment plants and transported by truck to arable or pasture land. Sludge constituents including heavy metals are monitored by the Niersverband laboratory. Sludges with concentrations of metals above limits set by the federal government are not disposed of on land without permission of supervising authorities. A sludge application of 100 cu m/ha using sludge with a total copper content of about 1000 ppm raises the copper content of the soil by about 2 ppm. Better thickening and homogenization of the sludge and optimization of the transport system by using 19 cu m tankers are suggestions for future improvement of the sludge disposal scheme. Sludge pasteurization concentrated at large plants with sufficient digester gas supply is being evaluated. (Small-FRC)
W81-02161

THE TREATMENT OF INDUSTRIAL WASTE WATER SLUDGE FROM A BIOLOGICAL PURIFICATION PLANT WITH COMPLETE N-REMOVAL,
DSM's Central Lab., Geleen (Netherlands). Environmental Research Dept.
E. W. Hendrikx.
Progress in Water Technology, Vol 12, No 5, p 351-357, 1980. 1 Fig, 4 Tab, 2 Ref.

Descriptors: *Sludge treatment, *Sludge disposal, *Neutralization, Lime, *Nitrogen removal, Fertilizers, Industrial wastes, Chemical industry, Dewatering, Drying, Nutrients, Soil disposal fields, *Netherlands.

Sludge treatment and disposal methods used at a chemical plant are reviewed. Purification of waste water from DSM's chemical plants is effected using a low-load activated sludge plant with a capacity of approximately 1 million population equivalents. The quality of the sludge produced depends on the neutralizing agent used. Sludge obtained after the addition of NaOH was less capable of being thickened than when CaO was used. Drying was the only sludge treatment method suitable for a sludge with high lime content. Mechanical dewatering and thermal drying were evaluated. The sludge was analyzed to see if it was suitable for use as a fertilizer. Sludge produced using NaOH was rich in nutrients, but it was decided to use CaO, which produces a larger quantity of sludge with less nutrients. At present the sludge is used as a liming agent for acid soils. Sludge that cannot be spread on land is dried using a thermal drying method. Sludge concentrations are kept below certain levels to avoid pump failures when the sludge is pumped from the water treatment plant to the sludge treatment plant. Also, sludge in the storage tanks is stirred to keep the concentration even. (Small-FRC)
W81-02170

SLUDGE DISPOSAL PRACTICES IN THAMES WATER AUTHORITY,
Thames Water Authority, London (England).
W. J. Dickens.

Progress in Water Technology, Vol 12, No 5, p 341-350, 1980. 1 Fig, 5 Tab, 3 Ref.

Descriptors: *Sludge disposal, *Sludge treatment, *Soil disposal fields, Municipal wastes, Heavy metals, Monitoring, Incineration, Anaerobic digestion, Filtration, *Thames Water Authority, United Kingdom.

The sizes and types of sewage treatment works and the quantities and types of sludge produced are described for the Thames Water Authority. The authority treats 213,200 tons/year of sludge by anaerobic digestion, 25,800 tons/year by filter press, 8900 tons/year by vacuum filter, 4400 tons/year by raw application to land, and 1600 tons/year other. Disposal is by land application for agricultural purposes (123,000 ton/year), sea discharge (131,000 tons/year), and incineration (2400 tons/year). Most of the liquid sludge applied to land is in the digested form, and direct surface spreading has not led to any enviromental problems with respect to odor. There are restrictions on metal concentrations in sludge for zinc, cadmium, lead and mercury. Thus, sludge and soil to which sludge has been applied are monitored for metal content. Sludge is sampled daily and measured for nitrogen, phosphorus, dry solids, total cadmium, copper, lead, zinc, and chromium. (Small-FRC)
W81-02171

THE PRAIRIE PLAN - THE FIRST DECADE, THE SECOND DECADE - THE UNITED STATES' LARGEST RECYCLING SYSTEM,
Metropolitan Sanitary District of Greater Chicago, IL.
N. J. Melas.
Progress in Water Technology, Vol 12, No 5, p 331-340, 1980.

Descriptors: *Soil disposal fields, *Agriculture, *Fertilizers, *Sludge disposal, Municipal wastes, Industrial wastes, Digestion, Nitrogen, Phosphorus, Crop production, Illinois, Metropolitan Sanitary District of Greater Chicago, *Chicago.

Digested waste water solids are recycled at the Metropolitan Sanitary District of Greater Chicago's Prairie Plan site. This water management district is responsible for domestic wastes produced by a population of 5,500,000 and an additional industrial waste load of 2 billion gallons per day. During the 1960's, the district used heat drying to treat sludge and then sold the material as a fertilizer base. This process caused air pollution, and was replaced by a program to use the solids to enrich agricultural lands. Through the end of 1978, 12.9 million wet tons of sludge have been barged to a site in Fulton County. The tandem disc has been the most satisfactory method of incorporating the sludge. The district purchased a 300 HP rock crushing soil stabilizer which may perform better than the tandem disc. The fertilizer is rich in nitrogen and phosphorus. In 1978, the application site produced 36,685 bushels of corn, 2247 bushels of soybeans, 101,797 bales of hay, and 500 bushels of rye. Processing and distribution costs were as follows in 1978: digestion $47/dry ton, barging $48/dry ton, and application $83/dry ton. (Small-FRC)
W81-02172

DISPOSAL OF SECONDARY SLUDGE IN THE KRAFT RECOVERY SYSTEM,
Institute of Paper Chemistry, Appleton, WI.
W. J. Frederick, T. M. Grace, and T. W. Joyce.
Tappi, Vol 64, No 1, p 59-62, January, 1981. 1 Fig, 6 Tab, 6 Ref.

Descriptors: *Disposal, *Pulp wastes, *Incineration, *Sludge disposal, Economics, Waste water treatment, Pulp and paper industry, Cost estimates, Energy, Evaporators.

Secondary sludge from pulp and paper mills was pretreated with white liquor and added to the weak black liquor prior to the evaporation step and subsequent disposal by incineration. Most of the insoluble material (Ca, Mg, and P) was removed with the dregs. Chloride levels in the effluent were low for unbleached kraft mills (0.2 to 88 ppm) but were 297 ppm for bleached kraft mills. These levels were reduced by dewatering the sludge to 5-10% solids. Aluminum accumulation could cause evaporator fouling and interfere with causticizing. This problem was not solved in this study. The rate of evaporator fouling was reduced by 93-99% when the secondary sludge was predigested with the white liquor. Energy balances showed that the energy break-even point for 15 kg of sludge solids per absolutely dry ton added to the weak black liquor was 5.5% solids when predigesting at pH 13 and 100C; 4.4% solids when predigesting at pH 12.3 and 100C. Costs of the process decreased as predigestion temperature dropped and as the pH dropped below 13. Costs also declined with sludge dewatering in the range of 1 to 5%. Dewatering to above 10% was not cost-justified. (Cassar-FRC)
W81-02178

CHLORINE DYNAMICS DURING INACTIVATION OF COLIFORMS, ACID-FAST BACTERIA AND YEASTS,
Rensselaer Polytechnic Inst., Troy, NY.
For primary bibliographic entry see Field 5D.
W81-02186

TRACE ORGANIC BEHAVIOR IN SOIL COLUMNS DURING RAPID INFILTRATION OF SECONDARY WASTE WATER,
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W81-02190

FATE OF PETROLEUM HYDROCARBONS IN SEWAGE SLUDGE AFTER LAND DISPOSAL,
National Water Research Inst., Burlington (Ontario).
D. Liu.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 4, p 616-622, October, 1980. 3 Fig, 13 Ref.

Descriptors: *Sludge, *Sewage, *Organic compounds, *Agriculture, *Soil disposal fields, Heavy metals, Toxicity, Oil, Soil properties, Soil testing, Gas chromatography, Analytical techniques, Lysimeters, Moisture content.

Results of a study of farmland disposal of sewage sludge are presented. High concentrations of petroleum hydrocarbons have been detected in sewage sludge and are known to be toxic to plants because of their damaging effects on photosynthesis. The vertical distribution of sludge petroleum hydrocarbons observed in silt loam soils one year after application demonstrates a high capacity for the soil to degrade and retain the lipophilic substances. Sludge also enhances the biological activity of the soil, further accelerating the degradation of hydrocarbons. It is thought that under normal sludge application conditions, hydrocarbon buildup to any significant level would be unlikely. Further investigation of long-term effects is recommended. (Titus-FRC)
W81-02226

ROOT ZONE NITROGEN SIMULATION MODEL FOR LAND APPLICATION OF SEWAGE SLUDGES,
Illiois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
P. O'Brien, and W. J. Mitsch.
Ecological Modelling, Vol 8, p 233-257, January, 1980. 14 Fig, 3 Tab, 59 Ref.

Descriptors: *Sewage sludge, *Model studies, *Root zone, Nitrogen, Effects, Fertilizers, Nitrate, Leaching, Kinetics, Crop production, Soil amendments, Nitrogen compounds, Sludge treatment, Simulation analysis, Nutrients, Waste disposal.

A root zone nitrogen simulation model was designed to evaluate long term effects of various sewage sludge and ammonia nitrogen fertilizer applications upon soil root zone nitrogen effects. Specific effects studied were root zone nitrogen build-up, crop nitrogen uptake (as a percentage of applied nitrogen), crop yield and nitrate nitrogen leaching. Model results showed that nitrate nitrogen leaching had a direct linear relationship to the simulated sludge application rates. For each metric ton of sludge incorporated into the farm soils, the leaching rate increased 21 kilograms/ha/year. The leaching rate increased 22 kilograms/ha/year for each metric ton of sludge incorporated into the stripmine soils. Leaching rates 50% lower than incorporation amounts resulted from surface application of sludge. The maximum uptake of nitrogen was determined from Michaelis-Menten/Monod kinetics to be 135 kilograms/ha/year for an incorporated loading rate of 25 metric tons/ha/year. Over a 50 year period organic nitrogen in the root zone build-up due to sludge application rates of 25 metric tons/ha/year would range from 8,400 to 10,000 kilograms/ha, depending on the site. Simulated application of 300 kilograms/ha/year of ammonia nitrogen gave a 98 kilogram/ha/year crop nitrogen yield, representative of an average yield for the US corn belt. Most of the model findings were in agreement with literature values. (Geiger-FRC)
W81-02259

PALEOHYDROLOGY OF THE SOUTHERN GREAT BASIN, WITH SPECIAL REFERENCE TO WATER TABLE FLUCTUATIONS BENEATH THE NEVADA TEST SITE DURING THE LATE( ) PLEISTOCENE,
Geological Survey, Reston, VA. Water Resources Div.
I. J. Winograd, and G. C. Doty.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $12.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-569, 1980. 91 p, 23 Fig, 3 Tab, 52 Ref.

Descriptors: *Paleohydrology, *Aquifer characteristics, *Radioactive waste disposal, *Great Basin, *Nevada, Water table, Water level fluctuations, Groundwater movement, Underground waste disposal, Underground storage, Path of pollutants, Hydrogeology, Pleistocene epoch, *Nevada Test Site(NV), *Ash Meadows(NV), Unsaturated zone.

Knowledge of the magnitude of water-table rise during Pleistocene pluvial climates, and of the resultant shortening of groundwater flow path and reduction in unsaturated zone thickness, is mandatory for a technical evaluation of the Nevada Test Site (NTS) or other arid zone sites as repositories for high-level or transuranic radioactive wastes. The distribution of calcitic veins filling fractures in alluvium, and of tufa deposits between the Ash Meadows spring discharge area and the Nevada Test Site indicates that discharge from the regional Paleozoic carbonate aquifer during the Late( ) Pleistocene pluvial periods may have occurred at an altitude about 50 meters higher than at present and 14 kilometers northeast of Ash Meadows. Use of the underflow equation (relating discharge to transmissivity, aquifer width, and hydraulic gradient), and various assumptions regarding pluvial recharge, transmissivity, and altitude of groundwater base level, suggest possible rises in potentiometric level in the carbonate aquifer of about -90 meters beneath central Frenchman Flat. During Wisconsin time the rise probably did not exceed 30 meters. Water-level rises beneath Frenchman Flat during future pluvials are unlikely to exceed 30 meters and might even be 10 meters lower than modern levels. Neither the cited rise in potentiometric level in the regional carbonate aquifer, nor the shortened flow path during the Late( ) Pleistocene preclude utilization of the NTS as a repository for high-level or transuranic-element radioactive wastes provided other requisite conditions are met as this site. Deep water tables, attendant thick (up to several hundred meter) unsaturated zones, and long groundwater flow paths characterized the region during the Wisconsin Stage and probably throughout the Pleistocene Epoch and are likely to so characterize it during future glacial periods. (USGS)
W81-02372

5F. Water Treatment and Quality Alteration

THE OCCURRENCE OF CLOSTRIDIUM BOTULINUM IN RAW-WATER STORAGE AREAS AND THEIR ELIMINATION IN WATER TREATMENT PLANTS,
Rijsinstituut voor de Volskgezondheid, Bilthoven (Netherlands). Lab. for Zoonosen Lebensmittelmikrobiology.
S. Notermans, A. H. Havelaar, and J. Schellart.
Water Research, Vol 14, No 11, p 1631-1635, November, 1980. 4 Tab, 16 Ref.

Descriptors: *Filters, *Water purification, *Clostridium, *Raw water, Water quality, *Water treatment, Public health, Sludge, Sands, Water quality control, Ozone, Bioassays, *Netherlands, Reservoirs, Potable water.

Large scale outbreaks of waterfowl botulism in 1976 in the Netherlands have raised questions about the effectiveness of Clostridium botulinum removal by three water treatment plants. The Leiduin, Weesperkarspel and Kralingen treatment plants each receive water from three storage areas where C. botulinum was detected in bottom mud samples. The extent of removal of the bacterium by routine treatment operations of the plants was examined, and model experiments were conducted to evaluate the efficiency of slow sand filters in removing Clostridium spores. Samples were taken from coagulation sludge and the upper layers of filters in all three plants and also from the bottom sediments of ozone treatment chambers from the Weesperkarspel plant. The presence of C. botulinum was determined by mouse antiserum bioassays. Results of the three-year investigations (1977-1979) indicated that slow sand filters were adequate for retaining C. sporogenes spores. In two of the plants, the Weesperkarspel and Kralingen plants, C. botulinum was found only in the early purification stages. At the Leiduin facility, Clostridium bacteria were also detected on the slow sand filters, the last step of purification. The bacterium was detected in only the upper sand layers of this plant, and was never found in the filter water of any of the three treatment facilities. (Geiger-FRC)
W81-02191

OPERATING EXPERIENCES WITH DISSOLVED AIR FLOTATION ON VARIOUS RAW WATERS,
Water Research Centre, Marlow (England). Medmenham Lab.
A. J. Rees, D. J. Rodman, and T. F. Zabel.
Aqua, Vol 8, p 0170-0177, 1980. 8 Fig, 10 Tab, 5 Ref.

Descriptors: *Flotation, *Dissolved air flotation, *Water treatment, Filtration, Coagulation, *United Kingdom, Sludge, *Pilot plants, Flocculation, Turbidity, Water quality, Algae, Surface waters, Separation techniques.

Raw surface waters with different characteristics were treated with a 95 cu meter per hour dissolved air flotation process in large-scale pilot plant studies. Five waters underwent primary clarification at five separate treatment works in the United Kingdom. Flotation was especially effective in two types of water--stored water containing heavy algal loads and soft, stored, low turbidity, highly-colored water. Treatment of two low turbidity waters produced difficulties in floc formation. High turbidity water required extra air. Rapidly changing raw water qualities caused difficulties in adjusting doses of chemicals; storage is suggested in this situation. Dissolved air flotation plants can operate at a surface loading of up to 12 meters per hour, with a start-up time of 45 min. Flocculation time was 12-20 min. (Cassar-FRC)
W81-02251

PLAYGROUND AND WTP ARE GOOD NEIGHBORS,
R. P. Baker.
Water and Wastes Engineering, Vol 17, No 11, p 47-50, November, 1980. 1 Fig, 4 Tab.

Descriptors: *Treatment facilities, *Water treatment, *Recreation facilities, Parks, Water softening, Chlorination, Disinfection, Potable water, Ohio, Orbison Park.

A 10 mgd lime-soda softening water treatment plant was built in Orbison Park, a heavily used public park in Sidney, Ohio. The treatment process includes pretreatment with activated carbon, chlorine, or chlorine dioxide; coagulation/flocculation; lime-soda softening; clarification; recarbonation; and disinfection. Water also flows through ozonation basins to be equipped when ozonation becomes justifiable. The raw water pumping station and the sludge lagoon are located in the park. The new plant has a pleasing and unobtrusive design. Tennis courts are built on the clear well, and dust, noise and odor problems are minimized. During its first year of operation, the plant has supplied Sidney with high-quality water at adequate pressures. The park system has also been measurably improved. (Small-FRC)
W81-02261

5G. Water Quality Control

A DILUTION MODEL APPLIED TO A SYSTEM OF SHALLOW EUTROPHIC LAKES AFTER DIVERSION OF SEWAGE EFFLUENTS,
Uppsala Univ. (Sweden). Inst. of Limnology.
I. Ahlgren.
Archiv fur Hydrobiologie, Vol 89, No 1/2, p 17-32, June, 1980. 7 Fig, 5 Tab, 35 Ref.

Descriptors: *Model studies, *Eutrophication, Phosphorus compounds, *Eutrophic lakes, Nitrogen compounds, *Sewage effluents, Waste dilution, *Sweden, Lakes, Limnology, Chlorophyll, Photosynthesis, Nutrients, Mathematical studies, Sediments, Winds, Algae, Water pollution control, Path of pollutants.

A simple hydraulic dilution model was used to compare predicted nitrogen and phosphorus concentrations with those observed in a chain of four heavily eutrophicated shallow lakes north of Stockholm, Sweden, after all sewage effluents were diverted in 1970. Total P loadings were reduced by 80-90%, and total N loadings by 50-90%. The model successfully predicted P concentrations using a sediment retention coefficient of zero, but nitrogen fixation and denitrification produced differences between calculated and observed N concentrations. The average annual amplitudes in P levels were correlated with wind fetch over lake surface divided by mean depth, thus showing that differences among the lakes may depend on wind-generated turbulence at the sediment surface. Nitrogen was the limiting factor in chlorophyll a concentration. The deepest of the four lakes showed decreased chlorphyll contents and increased Secchi disc transparencies since 1974. The other lakes did not have this tendency; in fact, algal blooms have been more severe in recent years. (Cassar-FRC)
W81-02231

THE UNITED NATIONS INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE,
United Nations Educational Scientific and Cultural Organization, Paris (France). United Nations Development Programme.
For primary bibliographic entry see Field 6E.
W81-02250

NONPOINT POLLUTION CONTROL -- TOOLS AND TECHNIQUES FOR THE FUTURE, PROCEEDINGS OF A TECHNICAL SYMPOSIUM.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182156. Price codes: A14 in paper copy, A01 in microfiche. Symposium held in Gettysburg, PA, June 11-13, 1980. Interstate Commission on the Potomac River Basin, Rockville, Maryland. Technical Publication 81-1, January, 1981. 299 p. OWRT-C-90054-T(No 9615)(1).

Descriptors: *Nonpoint pollution sources, *Water pollution sources, *Water pollution control, *Potomac River basin, Best management practices, Urban Runoff, Agricultural runoff, Erosion control, Sediments, Land use, Pesticides, Eutrophication, Model studies, Mine drainage, Soil erosion, Farm wastes, Effluents, Virginia.

Thirty-two papers given at the symposium by experienced investigators in nonpoint water pollution are presented. Nonpoint water pollution, pollution from diffuse sources such as runoff from agriculture, forestry, and urban land development, accounts for up to 50% of the pollution in some rivers. Past water pollution control has emphasized point sources, and much progress has been made with these sources. Section 208 of the Federal Water Pollution Control Act Amendments has focused pollution control efforts on the identification and control of nonpoint sources. The papers are classified in five categories: (1) perspectives on nonpoint pollution control, (2) case studies of nonpoint sources of pollution, (3) modeling tools for evaluation of nonpoint pollutants, (4) control measures, and (5) planning and implementation strategies. A majority of the papers deal with the Potomac River basin and, in particular, the Occoquan watershed in Virginia. (See W81-02277 thru W81-02308) (Seigler-IPA)
W81-02276

NONPOINT POLLUTION CONTROL FROM THE STANDPOINT OF RESEARCH,
Office of Water Research and Technology, Washington, DC.
G. Cobb.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 7-10, 1981.

Descriptors: *Nonpoint pollution sources, *Research priorities, *Water pollution control, *Water pollution sources, Acid rain, Erosion, Marshes, Wetlands, Pathways, Pesticides, Urban runoff, Land use, Eutrophication, Environmental effects, Cycling, Sediments.

Nonpoint pollution of the nation's waterways and of groundwater represents a group of research priorities that are recognized by the Department of the Interior's Office of Water Research and Technology (OWRT). OWRT is charged with 'assuring an adequate supply of water of good quality for the nation's needs through water-related research and practical application of R and D results.' OWRT supports 54 water research centers and a focused research program; it also operates the Water Resources Scientific Information Center. Nonpoint pollution research is needed to identify the source, amount, and impacts of the pollutants entering our water resources from a variety of land use activities. A knowledge of the fate and cycling of nitrogen and phosphorus is needed along with more information about the fate and pathways of the over one billion pounds of pesticides manufactured in the United States every year. Other nonpoint pollution research areas include environment transport analysis, the limits of environmental protection, application methods, marshes and wetlands as barriers to contamination, erosion and sediment control, and acid rain. Research is the key to the solution of nonpoint pollution problems. (See also W81-02276) (Seigler-IPA)
W81-02277

NATIONAL PERSPECTIVES ON NONPOINT POLLUTION CONTROL,
Environmental Protection Agency, Washington, DC. Water Planning Div.
C. Myers.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 11-16, 1981.

Descriptors: *Nonpoint pollution sources, *Water pollution sources, *Federal project policy, *Research priorities, Urban runoff, Agriculture, Groundwater, Water pollution control, Best management practices, Grants, Government finance,

Research and development, Pesticides, Government supports.

Nonpoint pollution control is being increasingly recognized in Washington as a problem that needs action. New initiatives are being taken in this area by Congress, the Environmental Protection Agency (EPA), the Agriculture Department, the Department of Interior, and other Federal agencies. EPA's Section 208 and its grant funds are aimed directly at nonpoint pollution with emphasis on urban runoff, agricultural runoff, and groundwater contamination. EPA has developed the National Urban Runoff Program to prepare a data base on the costs and impacts of urban runoff pollution and controls. Thirty prototype projects to test control methods are being supported by Section 208. Initial 208 plans indicate that agricultural runoff is the most widespread cause of nonpoint pollution. Government agencies are aiding farmers and ranchers in the implementation of best management practices. Groundwater protection research is being funded as part of the Water Quality Management Program. The understanding of a wide range of public agencies and public interest is needed for success in nonpoint pollution control. (See also W81-02276) (Seigler-IPA)
W81-02278

A LOCAL RURAL PERSPECTIVE ON NONPOINT POLLUTION CONTROL,
Brooke-Hancock-Jefferson Metropolitan Planning Commission, Weirton, WV.
J. Louthan.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 26-29, 1981.

Descriptors: *Farm wastes, *Nonpoint pollution sources, *Water pollution control, *West Virginia, Agriculture, Best management practices, Soil erosion, Fertilizer, Pesticides, No-till farming, Farm equipment, Domestic animals, Agricultural engineering, Water pollution sources.

The Environmental Protection Agency has approved West Virginia's agriculture 208 plan which addresses nonpoint source pollution in three major areas: land management, nutrient management, and animal wastes management. In the past 40 years much progress has been made in land management and, in Jefferson County, West Virginia, approximately 90% of all row crops are now grown by the no-till methods which produce one tenth the erosion of conventional tillage methods. Despite this progress, more research is needed on chemical application and alternative methods to pest control. Inflation and rising energy costs have done much to promote nutrient management, however, efficient use of fertilizer demands proper calibration of expensive equipment and excellent management practices on the part of the farmer. Animal waste handling systems are working well but they are expensive and cannot be justified through operational efficiency alone. Another area of concern to farmers is that of sludge application to farm land, which is viewed very negatively. (See also W81-02276) (Seigler-IPA)
W81-02281

A LOCAL URBAN PERSPECTIVE ON NONPOINT POLLUTION CONTROL,
Montgomery County Council, Rockville, MD.
N. Potter.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 30-34, 1981. 1 Fig.

Descriptors: *Maryland, *Potomac River, *Nonpoint pollution sources, *Urbanization, Sewage treatment, Effluents, Sludge, Education, Monitoring, Modeling, Water pollution control, Water pollution sources, Regulations, Cities.

Areas requiring attention from the urban perspective on nonpoint pollution control include education, monitoring, modeling, and a more balanced attitude about pollution problems. Montgomery County, Maryland, has experienced many problems in its attempt to reduce the pollution of the Potomac River while still providing needed utility services to this urban area. A major problem area is that of sewage treatment for a large urban area and the resulting effluent and sludge. Past emphasis has been placed almost entirely on point source pollution to the Potomac River while nonpoint pollution has been neglected despite its magnitude. An equitable formula for reducing nonpoint pollution will be difficult to develop. At present, much can be done if farmers and developers use best management practices. There is also a great need for more public and official education so that in the future the programs that are enacted will be more economical, rational, and related to the problem to be solved. (See also W81-02276) (Seigler-IPA)
W81-02282

THE PUBLIC'S PERSPECTIVE ON NONPOINT SOURCES,
Capitol Region Planning and Development Agency, Harrisburg, PA.
R. K. Hoffman.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 35-38, 1981. 2 Tab.

Descriptors: *Pennsylvania, *Nonpoint pollution sources, *Water pollution sources, *Water pollution control, Acid mine water, Urban runoff, Agriculture, Erosion, Construction, Advisory councils, Regulation, Water quality, Coal mine wastes, Coal mines, Water conservation, Education.

Pennsylvania's 208 planning effort, the Comprehensive Water Quality Management Plan (COWAMP) has ranked the five major nonpoint sources of water pollution as: (1) agricultural runoff, (2) urban runoff, (3) construction-site runoff, (4) contamination from malfunctioning on-lot disposal systems, and (5) acid mine drainage. COWAMP uses three public information devices, advisory committee meetings, public workshops on the county level, and a bimonthly water quality newsletter. Input from the workshops and from the advisory councils shows that the public's perspective on nonpoint sources depends upon where they live. To farmers, the preservation of prime farmland in a time of increasing development is a major concern. Those in urban areas feel that better planning and enforcement of the Stormwater Management and Floodplains Management Acts will help to control urban and construction-site runoff. The advisory committees recommend an intensive public education program coupled with more stringent enforcement of existing regulations on nonpoint source pollution. (See also W81-02276) (Seigler-IPA)
W81-02283

STRATEGIES FOR CONSIDERING POINT AND NONPOINT CONTROL TRADEOFFS FOR THE UPPER POTOMAC ESTUARY,
National Capitol Region Transportation Board, Washington, DC. Dept. of Environmental Programs.
M. Sullivan, S. Freudberg, and C. Wiegand.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 225-244, 1981. 8 Fig, 1 Tab, 13 Ref.

Descriptors: *Nonpoint pollution sources, *Potomac River, *Optimization, *Efficiencies, *Cost-benefit analysis, Feasibility studies, Federal funding, Upstream loading, Point sources, Effluents, Water pollution sources, Water pollution, Urbanization, Cities.

The Metropolitan Washington Council of Governments (MWCOG) is investigating the possibilities for cost-effective tradeoffs between further control of point source effluents versus nonpoint pollution control in order to determine the optimal blend of controls for the Potomac estuary. Over the last decade point source loadings have been decreased significantly in accordance with the Clean Water Act. This decrease has increased the importance of local nonpoint and upstream loadings. As part of MWCOG's investigation, average annual pollutant loads and the effectiveness of nonpoint control alternatives were compared to currently mandated point source controls. The comparison shows that upstream loading from beyond the metropolitan area is the largest of all loading sources for the estuary, indicating that State nonpoint source control programs are needed. Tradeoffs between local point and nonpoint control alternatives may be cost-effective and further analysis is warranted. Non-structural practices appear to be very cost-effective. Should tradeoff analysis indicate the need for nonpoint source control programs, Federal funding will be needed for local jurisdictions. (See also W81-02276) (Seigler-IPA)
W81-02301

THE DEVELOPMENT AND CONTENT OF THE AGRICULTURAL COMPONENT OF THE MARYLAND 208 PLAN,
Soil Conservation Service, College Park, MD.
W. A. Knight.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 245-251, 1981. 7 Ref.

Descriptors: *Agricultural runoff, *Nonpoint pollution sources, *208 plans, *Maryland, Mapping, Soil conservation, Erosion, Farm wastes, Water pollution sources, Water pollution, Programs, Planning, Best management practices, Workshops, Information systems, Watershed protection.

The program for management of agricultural nonpoint sources in Maryland consists of a voluntary effort with the State Soil Conservation Committe and soil conservation districts, with The Maryland Water Resources Adminiistration having the enforcement authority. The program is identifying critical erosion and animal waste problem areas where soil conservation and water quality plans will be implemented. The program has developed assessment procedures and best management practices so that landowners can prepare their own individual plans. An information management system has been developed to help identify critical areas, to aid in the refinement of the implementation program, and to report progress. As part of this information system a mapped inventory of managerial and physical information on State farmland has been developed. Through the use of color codes, the maps provide an instantaneous overview of the conservation treatment status of any watershed. Maryland has received tentative Environmental Protection Agency approval of its agricultural 208 plan. (See also W81-02276) (Seigler-IPA)
W81-02302

THE STATEWIDE 208 NONPOINT SOURCE CONTROL PROGRAM FOR VIRGINIA,
Virginia Polytechic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
E. Sutherland.
In: Nonpoint Pollution Control--Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 294-299, 1981. 10 Ref.

Descriptors: *Virginia, *Nonpoint pollution sources, *Best management practices, Urban runoff, Agricultural runoff, Forest management, Dredging, Mining, Stormwater runoff, Erosion control, Sedimentation, Water pollution control, Water pollution sources, Saltwater intrusion, Handbooks.

The Virginia State Water Control Board has developed six handbooks outlining the Best Management Practices (BMP) to reduce nonpoint pollution from various land use catergories. The handbooks provide planning considerations, design criteria, and recommended construction specifications for every practice. The Agricultural BMP Handbook considers three practices: erosion and sediment control, pesticide and fertilizer control, and animal waste management methods. The Forestry BMP Handbook gives information of access roads and trails, site preparation, harvesting control, and pesticide controls. The Urban BMP Handbook covers good housekeeping methods, stormwater runoff controls, and sewer system management. The Hydrologic Modification Handbook covers the reduction of the ecological impact of channel modifications, dredging, spoil disposal, and good reservoir management. The Sources Affecting Groundwater Handbook includes the prevention

of saltwater intrusion. The Surface Mining Hankbook covers sediment runoff from coal and other mineral mining. (See also W81-02276) (Seigler-IPA)
W81-02308

CONTROL OF TOXICS IN THE UNITED STATES,
Corvallis Environmental Research Lab. OR.
J. C. McCarty.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173825, Price codes: A13 in paper copy, A01 in microfiche. In: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the Fifth United States-Japan Experts Meeting, Nov., 1979, New Orleans, LA. Environmental Protection Agency Report EPA-600/9-80-044, Sep., 1980, p37-44. 1 Tab, 11 Ref.

Descriptors: *Legislation, *Federal jurisdiction, *Water pollution control, *Toxins, *Water pollution standards, Toxicity, Pollution abatement, Environmental control, Industrial wastes, Air pollution, Water pollution, Soil contamination, Ecosystems, Waste disposal.

In recent years many federal laws have been enacted, and existing laws amended, in response to increasing incidents of toxic substances appearing in the food, air, water, and soil of the United States. The early legislation focused on controlling pollution in a medium after the pollutant had been generated. The methods included setting ambient air standards or receiving water standards and specific emission or discharge standards to limit the amount of a pollutant allowed into the environment. More recent legislation supports a preventive philosophy, in that chemicals are to be tested before they can be manufactured for commercial use. The evolving toxic control philosophy emphasizes the need to protect total ecological systems and to integrate the regulation of industrial discharges to insure that the requirements for air, water and solid waste discharges are compatible. The responsibility for this coordination currently rests with the Council on Environmental Quality. The problems facing this process include the enormous number of chemicals which need testing, the lack of knowledge of long-term effects of chemicals, and the difficulty of deciding on final disposal sites and methods. (Brambley-SRC)
W81-02315

DISTRIBUTION AND CONCENTRATION OF PCB IN THE HUDSON RIVER AND ASSOCIATED MANAGEMENT PROBLEMS,
New York State Dept. of Environmental Conservation, Albany. Bureau of Water Research.
For primary bibliographic entry see Field 6E.
W81-02317

THE SECTION 404 DREDGE AND FILL PROGRAM,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W81-02318

SEDIMENT PROBLEMS AND LAKE RESTORATION IN WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison. Office of Inland Lake Renewal.
R. C. Dunst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173825, Price codes: A13 in paper copy, A01 in microfiche. In: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the Fifth United States-Japan Experts Meeting, Nov 1979, New Orleans, LA. Environmental Protection Agency Rpt EPA-600/9-80-044, Sep 1980, p 103-113. 4 Fig, 3 Tab, 15 Ref.

Descriptors: *Lilly Lake(WI), *Water quality control, *Lake sediments, Dredging, *Lake restoration, *Sediment control, Sediments, Disposal, *Wisconsin, Lakes, Natural resources, Water resources, Reclamation, Heavy metals, Arsenic.

Concern for the water quality and future well-being of Wisconsin's lakes led to the creation of the Office of Inland Lake Renewal, with the responsibility of protecting and rehabilitating the lakes. Twelve dredging projects are underway or will begin soon, including lakes up to 205 hectares and sediment removal of up to 1,720,250 cubic meters. Solids content of the sediments range from 1-5 to 70-80%. The lack of disposal sites for the sediments has limited project implementation. Arsenic in sediments is a special problem. Organic sediments from Lilly Lake were deposited in an inactive gravel pit and within diked areas on agricultural land. Passage through a spray irrigation system proved impractical because of blockage by fibrous material. Rapid infiltration into the bottom and sides of the setting basins was short-lived due to the sealing characteristics of the sediments. Studies are underway to determine the effect of lake sediment application to upland soil on corn production. (Brambley-SRC)
W81-02319

CONTAMINANT MOBILITY IN DIKED CONTAINMENT AREAS,
Army Engineers Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5B.
W81-02322

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

ENVIRONMENTAL STUDY OF THE TAGUS ESTUARY,
Gore and Storrie Ltd., Toronto (Ontario).
For primary bibliographic entry see Field 5C.
W81-02205

AN EXPLORATORY APPLICATION OF ENTROPY MINIMAX TO WEATHER PREDICTION: ESTIMATING THE LIKELIHOOD OF MULTI-YEAR DROUGHTS IN CALIFORNIA,
Entropy Ltd., Lincoln, MA.
R. Christensen, R. Eilbert, O. Lindgren, and L. Rans.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182255, Price codes: A06 in paper copy, A01 in microfiche. Technical Report, Sept. 5, 1980. 105 p, 21 Fig, 13 Tab, 3 Append. OWRT-C-80049-P(No 8409)(1), 14-34-001-8409.

Descriptors: *Forecasting, *Weather forecasting, *Drought, Precipitation, Prediction, *California, *Time series analysis.

A new information theoretic technique was tested for long range forecasting of the probability of extended drought. Time-series data were obtained describing precipitation, stream flow, tree ring indices, atmospheric temperature and pressure, sea surface temperature, Palmer drought severity index, and other variables. The geographical region includes Far Western North America, and mid- and north Pacific Ocean; the time span extends from about 1850 to 1977. These time-series were analyzed for patterns enabling long range prediction of annual precipitation in a 7-station Sacramento-Tahoe region in California. Patterns were found in a randomly selected (training) half of the years enabling prediction of wet versus dry probabilities for the other (test) half with lead times of one, two or three years. The accuracy of the predictions on the test half of the data is 63%, statistically significant at the 94% confidence level. For comparison, the accuracy obtained for a random predictor is 50%, and the accuracy for a one-year persistence hypothesis is 54%, with negligible statistical significance. On extreme years (extremely wet or extremely dry), the predictive accuracy of the patterns rises to 78%, evidence of their physical meaningfulness. On extreme years, the accuracy of the persistence hypothesis, on the other hand, degrades to 51%. (Christensen-EL)
W81-02264

INTEGRATED ASSESSMENT AND MANAGEMENT OF WATER QUANTITY AND WATER QUALITY IN THE MERRIMACK RIVER BASIN, NEW HAMPSHIRE,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
S. L. Dingman, and B. E. Lindsay.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182214, Price codes: A07 in paper copy, A01 in microfiche. Water Resource Research Center, University of New Hampshire Research Report No 33, 1981. 116 p, 20 Fig, 7 Tab, 47 Ref, 9 Append. OWRT-A-050-NH(1), 14-34-0001-8031.

Descriptors: Water quantity, *Water quality, *Model studies, *Economic aspects, Water supply, *Available water, Water demand, *Merrimack River Basin, Water resource management, Supply and demand, *New Hampshire, Water resource planning, Water resource problems, Water supply sources.

Sound management of water-resource problems has four major requisites: (1) precise definition of the problem; (2) consideration of all potential alternative solutions; (3) appropriate objectives and criteria for choosing among alternatives; and (4) ability to analyze the alternatives with respect to the choice criteria. This report contributes to these objectives in ways that will be of practical use in water-resource planning in the New Hampshire portion of the Merrimack River Basin and in New England. It does this by separately considering the hydrologic and economic aspects. These two components can be combined into a single framework. The hydrologic analysis examines the nature of supply and demand in the context of water resources. Additionally, a quantitative planning-level framework for identifying the existence and nature of water-resource problems is developed. This framework allows evaluation of the degree to which any proposed management strategy will contribute to the solution of such problems. This model constitutes a simulation model that can accommodate any combination of alternatives, including those that affect demand as well as those that increase supply. The economic aspect of this study emphasizes a mixed-integer multiperiod programming model that utilizes hydrologic and economic data for identifying the discounted least cost of water supply, distribution, and scheduling for three communities. Preliminary sample data were used. This model can identify present water-supply sources that are economically feasible for the future, as well as new reservoirs, based upon projected water demands.
W81-02268

HSPF: A COMPREHENSIVE PACKAGE FOR SIMULATION OF WATERSHED HYDROLOGY AND WATER QUALITY,
Environmental Research Lab., Athens, GA.
T. O. Barnwell, and R. Johanson.
In: Nonpoint Pollution Control – Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 135-153, 1981. 10 Fig, 38 Ref.

Descriptors: *Model studies, *Computer models, *Nonpoint pollution sources, *Forecasting, Estimating, Mathematical models, Rainfall-runoff relationships, Pesticides, Erosion, Land use, Watersheds(Basins), Computer programs, Environmental effects, Soil types.

HSPF, the Hydrologic Simulation Program-Fortran, uses data about rainfall, temperature, solar radiation, land use, soil type, and agricultural practices to simulate the processes that occur in a watershed. Simulation with HSPF produces a time history of the quantity and quality of runoff with predictions of flow rate, sediment load, and nutrients and pesticide concentrations. From this prediction, the model simulates the processes that occur in stream channels in the watershed. HSPF has a data management system so that it can handle large amounts of input data and simulation output. HSPF's ability to simulate the continuous behavior of time-varying physical processes with statistical summaries allows it to be applicable to a wide variety of water resource problems. The model's

software designs include structural programming and top-down design. HSPF incorporates two runoff models, the Agriculture Runoff Management Model and the Nonpoint Source Model. (See also W81-02276) (Seigler-IPA)
W81-02294

A METHODOLOGY FOR ESTIMATING THE LOADS AND IMPACTS OF NONPOINT SOURCES ON LAKE AND STREAM WATER QUALITY,
Center for the Environment and Man, Inc., Hartford, CT.
R. Ahmed, and R. W. Schiller.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 154-162, 1981. 1 Fig, 3 Tab, 19 Ref.

Descriptors: *Model studies, *Nonpoint pollution sources, *Massachusetts, *Connecticut, Urban runoff, Erosion, Planning, Water pollution sources, Runoff forecasting, Surface runoff, Lakes, Lake stages, Phosphorus, Nutrients.

A model for computing loading estimates from nonpoint sources in a watershed (CLENS) was used to quantify the phosphorus in 16 lakes in Connecticut and Massachusetts as part of the development of preliminary management plans. The model is simple and can be used to develop quantitative estimates of nonpoint sources of pollution and their impact on water bodies. It can also be used to develop cost-effective management planning. CLENS is not computer-based although it is amenable to the use of computers. CLENS considers the following nonpoint sources: washoff from urban areas, erosion from other areas, washoff from barnyards and feedlots, leachate from landfills, washoff from roads, leachate from septic systems, and wet and dry fallout. CLENS was recently applied to Lake Waramaug, the second largest lake in Connecticut. Data from this application are given. CLENS has several advantages over a sampling program, it provides long-term estimates and it locates the specific sources and details the primary causes of the pollution. (See also W81-02276) (Seigler-IPA)
W81-02295

NEW METHODOLOGIES TO EVALUATE BEST MANAGEMENT PRACTICES,
CH2M/Hill, Reston, VA.
F. W. Ellis, R. C. Sutherland, and W. M. Alley.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 163-174, 1981. 8 Fig, 3 Tab, 11 Ref.

Descriptors: *Model studies, *Nonpoint pollution sources, *Urban runoff, *Computer models, Street cleaning, Detention ponds, Sediments, Transport, Best management practices, Particle size distribution, Water pollution, Water pollution sources, Erosion, Estimating, Runoff forecasting.

The Particulate Transport Model (PTM), the Street Cleaning Analysis Model (SCAM), and the Deposition Performance of Sediment in Trap Structures model (DEPOSITS) are new approaches for evaluating the particulate nature of many urban nonpoint source pollutants. They are valuable tools in predicting the effectiveness of Best Management Practices. PTM simulates the buildup of pollutants on urban surfaces, the transport of the sediment portion of the pollutants, and the effectiveness of runoff controls on transport. SCAM simulates the removal of accumulated pollutants by street sweeping. DEPOSITS accounts for the removal of transported particulate pollutants by detention ponds. All three approaches were used to perform a sensitivity analysis on a hypothetical catchment. Simulated were the impacts of catchment slope, initial particle size distribution, street sweeping impacts, and detention basin impacts. (See also W81-02276) (Seigler-IPA)
W81-02296

COST-EFFECTIVENESS FACTORS FOR URBAN BEST MANAGEMENT PRACTICES,
Northern Virginia Planning District Commission, Falls Church.
J. P. Hartigan, D. J. Biggers, H. A. Bonuccelli, and B. E. Wentink.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 199-212, 1981. 2 Fig, 18 Ref.

Descriptors: *Urban runoff, *Model studies, *Nonpoint pollution sources, *Best Management Practices, *Virginia, Urbanization, Occoquan River, Potomac River, Monitoring, Water sampling, Land use, Development, Water pollution, Water pollution sources, *Cost analysis, Water quality.

Continuous simulation studies of urban nonpoint pollution control measures were conducted for the Occoquan River basin, a major tributary of the Potomac estuary. The basin encompasses 580 sq mi and is located in the southern periphery of the Washington, DC, metropolitan area. An intensive monitoring study was used to develop nonpoint pollution loading factors. Twenty-one watersheds with homogeneous land use patterns were monitored for twenty-nine pollutants. The Nonpoint Pollution Sources model was used to derive 'land use-nonpoint pollution' relationships from the monitoring study data base. Using this base, best management practices (BMP) efficiency estimates were made for four categories of controls: source controls, detention basin controls, volume controls, and physical-chemical treatment controls. Results show that multipurpose stormwater management BMP can achieve substantial reductions in pollutants at a lower cost than other control measures such as sweeping and physical-chemical treatment. Multipurpose stormwater management BMP should be capable of minimizing additional deterioration of receiving water quality in urban development areas. (See also W81-02276) (Seigler-IPA)
W81-02299

COMPUTER-MODEL ANALYSIS OF THE USE OF DELAWARE RIVER WATER TO SUPPLEMENT WATER FROM THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM IN SOUTHERN NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
A. W. Harbaugh, J. E. Luzier, and F. Stellerine.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-123259, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-31, May, 1980. 41 p, 21 Fig, 4 Tab, 20 Ref.

Descriptors: Simulation analysis, Computer models, *Artificial recharge, *Delaware River, *New Jersey, *Model studies, Groundwater resources, Water supply, Aquifers, Forecasting, Potentiometric level, Saline water, Hydrogeology, Hydrographs, Coastal Plain(NJ), Southern New Jersey.

A computer model of the Potomac-Raritan-Magothy aquifer system in southern New Jersey was used to simulate the effects of supplementing groundwater with water from the Delaware River. Replacement of ground water pumpage with surface in a 150-square-mile area near Camden, N.J., was simulated. Artificial recharge of surface water was also simulated in the same area. A series of nine simulations was made. The simulations include the period 1974 to 2000. Two projections for water use were used. Also, in some of the model simulations a line of injection wells was simulated to prevent movement of saline water into pumping centers. The simulations indicate that heads will be as much as 100 feet higher in the year 2000 near the 150-square-mile area than they would be if no surface water had been used. In the model simulations, heads recover upon application of surface water, but start declining again within 2 years. The rate of head decline after surface-water application is slower than before surface-water application. (USGS)
W81-02348

PLANNING REPORT FOR THE SOUTHWEST ALLUVIAL BASINS (EAST) REGIONAL AQUIFER-SYSTEM ANALYSIS, PARTS OF COLORADO, NEW MEXICO, AND TEXAS,
Geological Survey, Albuquerque, NM. Water Resources Div.
D. W. Wilkins, W. B. Scott, and C. A. Kaehler.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $5.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-564, 1980. 39 p, 6 Fig, 75 Ref.

Descriptors: *Project planning, *Aquifer management, *Regional analysis, *Aquifer systems, *Alluvial aquifers, Aquifer characteristics, Model studies, Flow system, Geochemistry, Hydrogeology, Water utilization, Surface-groundwater relationships, Water quality, Data collections, Colorado, New Mexico, Texas, *Rio Grande, Regional Aquifer System Analysis program.

The study of the Southwest alluvial basins (east) will involve an analysis of the regional aquifer system in parts of Colorado, New Mexico, and Texas. This area has been divided into 22 basins. The study of the alluvial aquifer-system will be made in the following stages: (1) project planning, (2) literature searches, (3) compiling existing data, (4) data collection, (5) basin modeling, (6) regional aquifer modeling, and (7) reports. The regional aquifer study will be accomplished through studying each of the 22 basins. Data compilation and limited data collection will be part of each basin study. Digital computer models will be made for those basins where data are sufficient. A regional aquifer model will be developed from the basin models. In addition to this report, there will be basin hydrology reports and the final regional report. Included in the final report will be a description of the regional hydrology and geology. (USGS)
W81-02360

GROUNDWATER-LEVEL MONITORING FOR EARTHQUAKE PREDICTION--A PROGRESS REPORT BASED ON DATA COLLECTED IN SOUTHERN CALIFORNIA, 1976-79,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02382

6B. Evaluation Process

ENGINEERING PLANNING AND EVALUATION OF POTENTIAL RESERVOIR SITES.
Arkansas Univ., Fayetteville. Coll. of Engineering.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-175960, Price codes: A06 in paper copy, A01 in microfiche. 1980. 116 p, 5 Fig, 3 Tab, 17 Ref. OWRT-A-999-ARK(3).

Descriptors: *Arkansas, *Engineers estimates, *Sites, *Planning, *Reservoir sites, Evaluation, Surface waters, Topography, Geology, Impoundments, Streamflow, Water table, Drainage, Damsites, Surveys.

Potential reservoir sites in Arkansas were investigated based on hydrology, geology, and other engineering factors. The investigation was designed to identify sites where water may be impounded most effectively and economically to help insure adequate quantity for state, municipal, industrial and agricultural uses, plus export to other areas where water is scarce. Potential sites were selected based on terrain, streamflow, geological characteristics, storage requirements and present usage of the area to be inundated. In order of quantity of water availability, the most feasible undeveloped surfacewater was found in the basins of the White, Arkansas, Ouachita and Red Rivers. These have a combined total drainage area of 7,616 square miles, with a mean annual flow of 5,678,674 acre feet and a maximum volume of 9,539,783 acre feet. (Garrison-Omniplan)
W81-02151

EVALUATION AND REVISION OF SEDIMENT AND EROSION CONTROL PROGRAMS IN URBANIZING AREAS FOR NONPOINT SOURCE MANAGEMENT,
Regional Planning Council, Baltimore, MD.

S. R. Martin, and J. M. Helm.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 175-187, 1981. 1 Fig, 2 Tab, 19 Ref.

Descriptors: *Maryland, *Nonpoint pollution sources, *Pollution control, *Programs, *Evaluation, Performance, Erosion, Sedimentation, Regulations, Water pollution, Water pollution sources, Monitoring, Management, Optimization, Systems analysis, Urbanization, Urban runoff.

The Baltimore Regional Planning Council has reviewed Maryland's sediment control laws and has recommended program redesign strategies to modify existing programs to meet nonpoint source guidelines and to optimize program effectiveness. Evaluation results are grouped under major categories including: legal authority; policies and procedures; education and public participation; guidelines, standards, and specifications; plan preparation; plan review; program monitoring; and general findings. Evaluation results show that an evaluation team composed of sediment and erosion control pro fessionals, elected officials, and citizens is realistic and effective. Federal 208 regulations were found to be generally applicable and reasonable, however, regulations do not allow sufficient time for proper design. Some officials in local jurisdictions were reluctant to publicize findings and recommendations. Periodic, intensive evaluations and modifications of programs for nonpoint source control must become part of program operations to optimize effectiveness. (See also W81-02276) (Seigler-IPA)
W81-02297

COST-EFFECTIVENESS FACTORS FOR URBAN BEST MANAGEMENT PRACTICES,
Northern Virginia Planning District Commission, Falls Church.
For primary bibliographic entry see Field 6A.
W81-02299

STRATEGIES FOR CONSIDERING POINT AND NONPOINT CONTROL TRADEOFFS FOR THE UPPER POTOMAC ESTUARY,
National Capitol Region Transportation Board, Washington, DC. Dept. of Environmental Programs.
For primary bibliographic entry see Field 5G.
W81-02301

SELECTION OF POTENTIALLY CRITICAL AREAS FOR AGRICULTURAL LIVESTOCK WASTE IN MARYLAND,
Cooperative Extension Service, Centerville, MD.
H. L. Brodie, M. L. Rodevick, and R. J. Adkins.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 252-258, 1981. 2 Fig, 1 Tab, 4 Ref.

Descriptors: *Maryland, *Nonpoint pollution sources, *Agricultural runoff, *Manure, *Farm wastes, Animal wastes(Wildlife), Livestock, Cattle, Domestic animals, Feed lots, Poultry, Horses, Sheep, Water pollution sources, Ranking, Economic evaluation.

Watersheds in Maryland were ranked for potential nonpoint pollution impact based on livestock and poultry manure production. Manure production was based on average population inventory on any one given date. Annual production was used to indicate housing capacity when more than one group of animals was produced annually. Population data were refined by dividing poultry into broilers and chickens, and cattle into dairy, beef, and other cattle. Swine were divided into breeding and feeding swine. Assumed annual wet manure product in pounds per animal per year was: dairy cows, 36,000; beef cows, 23,000; other cattle, 15,500; breeding swine, 3,407; feeding swine, 2,227; broilers, 51; chickens, 77; horses, 16,425; and sheep, 1,460. Land use areas were delineated using computerized data from Maryland's geographic information system. Bacterial impact and severity factors were considered and a severity index was developed. Watersheds were ranked by the Animal Waste Factor = Bacterial Severity X Bacterial Impact X Manure Equivalent Density per Acre of Cropland and Pastureland within the watersheed. (See also W81-02276) (Seigler-IPA)
W81-02303

NONPOINT POLLUTION: FUTURE ECONOMIC AND FINANCIAL ISSUES,
Virginia Water Resources Research Center, Blacksburg.
W. R. Kerns.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 267-273, 1981. 10 Ref.

Descriptors: *Nonpoint pollution sources, *Control programs, *Cost-benefit analysis, *Economic analysis, Incentives, Regulation, Voluntary actions, Penalties, *Water pollution control, Water pollution sources, Management, Agencies, Funding, Alternative costs, Cost sharing.

Due to the extreme expense of a nonpoint pollution program based on the traditional regulation and control techniques, alternatives, and trade-offs must be considered in the development and implementation of a control program. Tools and techniques are being developed to determine the socially desirable level of pollution and what trade-offs are needed. Innovative incentive programs are needed to combat nonpoint pollution since those who bear the major costs of control are not the ones who enjoy the major benefit. An implementation program for controlling nonpoint pollution must consider the best way to change the behavior of land users, by regulation, incentives, penalties, or voluntary action. Approaches other than regulation and control are more effective and acceptable. Financial aspects must be considered and priorities for funding must be established. All alternatives for nonpoint pollution control programs must be carefully analyzed in order to obtain desired levels of water quality at a reasonable cost to everyone. (See also W81-02276) (Seigler-IPA)
W81-02305

ECONOMETRIC AND PROGRAMMING TOOLS FOR EVALUATION OF THE ECONOMIC IMPACTS OF NONPOINT POLLUTION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
K. H. Baum, D. Seal, and W. R. Kerns.
In: Nonpoint Pollution Control--Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 274-284, 1981. 1 Fig, 1 Tab, 20 Ref.

Descriptors: *Nonpoint pollution sources, *Computer models, *Model studies, *Economic impact, Best management practices, Linear programming, Dynamic programming, Recursive programming, Environmental effects, Computer programs, Simulation analysis, Numerical analysis, Water pollution.

Methodological procedures for modeling economic and environmental impacts resulting from the implementation of Best Management Practices to control nonpoint pollution are discussed. The methodologies considered are: linear programming, dynamic programming, econometric and simulation techniques, and recursive interactive or adaptive programming. Each procedure offers environmental modeling advantages, but each is also limited in the types of analyses which may need to be performed. Linear programming requires detailed crop and livestock budgets, technical input-output coefficients, and the relevant constraints system. Dynamic programming includes time within the modeling format and implicitly assumes a simultaneous feedback mechanism. Recursive programming models are in the general class of dynamic models where planning is determined by a single optimizing decision. Recursive interactive or adaptive programming models are superior due to their dynamic capability to investigate the normative and positive policy questions involved in environmental management, and due to their compatibility with other computer programs. (See also W81-02276) (Seigler-IPA)
W81-02306

DREDGING ON A COMPETITIVE BASIS,
Corps of Engineers, Fort Belvoir, VA. Dredging Div.
W. R. Murden, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173825, Price codes: A13 in paper copy, A01 in microfiche.
In: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the Fifth United States-Japan Experts Meeting, November, 1979, New Orleans, Louisiana. Environmental Protection Agency Report EPA-600/9-80-044, September, 1980, p 1-17.

Descriptors: *Dredging, *Sediments, *Channel improvement, Investment, Legislation, Unit costs, Equipment, Federal project policy, Dredges, Sediment control, Harbors, River beds, River training, *Costs, Bids, *Dredging equipment, Economics.

A rapid and significant decrease in workload and the relatively constant unit costs from 1963 to 1978 caused reluctance to invest in new equipment by the dredging industry and a reassessment of dredging equipment needs by the Corps of Engineers. The Industry Capability Program, which provides an opportunity for industry dredges to compete with Corps dredges, was implemented to encourage the industry to invest in new equipment, particularly seagoing hopper dredges. The background to the enactment of Public Law 95-269 in 1978 is presented. The law requires that the Corps of Engineers determine the minimum Corps fleet of dredges required to perform emergency and national defense work; that industry dredges be used only when Corps dredges are not available and within specific cost limits; and that the Corps retain a modern minimum fleet for emergency and defense purposes and sufficient other equipment to allow it and industry to carry out projects for improvements of rivers and harbors. The minimum Corps dredge fleet should be one large, four medium and three small class hopper dredges while the existing and planned industry dredge fleet consists of two large, six medium, and three small class hopper dredges. (Brambley-SRC)
W81-02314

STAFF REVIEW OF PROPOSED LOCK HAVEN FLOOD PROTECTION PROJECT.
Susquehanna River Basin Commission, Harrisburg, PA. Planning and Operations Div.
Publication No 71, November, 1980. 21 p, 1 Tab, 2 Maps.

Descriptors: *Pennsylvania, *Flood protection, *Civil engineering, *Dams, *Regional flood, Flood plains, Flood damage, Flood control, Diversion, Multi-purpose projects, Water resources development, Regional development, River regulation, Abatement, Hydraulic structures, *Lock Haven.

Since 1847 when recording of flood information was initiated, the city of Lock Haven, PA, has been flooded nineteen times with major floods occurring in 1889, 1936, 1946, 1950 and 1972. This review of the U.S. Corps of Engineers' proposed Lock Haven Flood Protection Project identifies relevant issues including a history of proposed regional flood control measures, consideration of alternatives to the project, project impact, upstream-downstream concerns, economic factors, and public response. The staff recommends that the project be included in the Susquehanna River Basin Commission's Comprehensive Plan for funding and construction, but suggests there be continuing consideration of a regional solution to flood control rather than a piecemeal approach. They also recommend that the Corps' final report acknowledge the remaining widespread vulnerability of communities along the West Branch of the Susquehanna River to flood damage after the Lock Haven project is completed. To determine flood impacts, an elevation-damage relationship was obtained with stage-damage relationship updated to 1980. Total existing average annual flood damages throughout the project area are estimated to be approximately $4.54 million. However, the staff report stresses that once the Lock Haven project is in place, future opportunity to develop upstream structures may be precluded. (Garrison-Omniplan)

W81-02339

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

BENEFIT TAXATION AND COST SHARING: MECHANISMS FOR ENCOURGAGING ACCEPTANCE OF NONPOINT POLLUTION CONTROL STRATEGIES,
Tennessee Univ., Knoxville. Dept. of Agricultural Economics and Rural Sociology.
W. Park, and L. Shabman.
In: Nonpoint Pollution Control--Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 285-293, 1981. 2 Tab, 4 Ref.

Descriptors: *Virginia, *Cost sharing, *Nonpoint pollution sources, *Best management practices, Land use, *Cost-benefit analysis, Cost-benefit ratio, Economics, Economic analysis, Water pollution sources, Water pollution, Urban runoff, Agricultural runoff.

Economic incentives and compensations are being considered in the Occoquan River basin to solve the problem of the economic inequity of nonpoint pollution control programs. With nonpoint pollution controls, the area bearing the most cost of control is not the area receiving the most benefit from the control. The Occoquan River basin encompasses parts of four counties in northern Virginia. Fauquier County with 70,592 acres of the area's agricultural land stands to gain only 1 to 3% of the water quality benefits from the implementation of Best Management Practices. Fairfax County, with only 6,775 acres of agricultural land, will gain 40 to 67% of the improved water quality benefits. Two scenarios, OPTIMISTIC and PESSIMISTIC can be applied to determine cost sharing predictions needed to make nonpoint pollution controls fair and acceptable to all counties. One appropriate mechanism for raising cost sharing funds would be a fee for recreational fishing. (See also W81-02276) (Seigler-IPA)
W81-02307

6D. Water Demand

INTEGRATED ASSESSMENT AND MANAGEMENT OF WATER QUANTITY AND WATER QUALITY IN THE MERRIMACK RIVER BASIN, NEW HAMPSHIRE,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
For primary bibliographic entry see Field 6A.
W81-02268

IRRIGATION WATER SUPPLY FOR THE COAST INDIAN COMMUNITY, RESIGHINI RANCHERIA, KLAMATH, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. P. Akers.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $1.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-404, May, 1980. 5 p, 1 Fig.

Descriptors: *Irrigation water, *Potential water supply, *Water demand, *California, Water resources, Agriculture, Water wells, Hydrology, *Klamath River(CA), *Resighini Rancheria(CA).

A required 1,100 gallons of water per minute for irrigating agricultural lands used by the Coast Indian Community on the Resighini Rancheria near Klamath, Calif., cannot be developed from wells. However, the required quantity of water might be developed from a trench installed in sand and gravel deposits that are hydraulically connected with the Klamath River. (USGS)
W81-02352

WATER RESOURCES OF THE PORT GAMBLE INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-02365

6E. Water Law and Institutions

THE UNITED NATIONS INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE,
United Nations Educational Scientific and Cultural Organization, Paris (France). United Nations Development Programme.
P. G. Bourne.
Aqua, Vol 8, p 17-20, 1980.

Descriptors: *United Nations, *Potable water, *International Drinking Water Supply and Sanitation Decade, *Environmental sanitation, *Water supply development, Public health, Resources, Water resources development, Human diseases, Diseases, Water policy, Project planning, Planning, Water users, Costs, Estimated costs.

The Decade, formally launched at a Special Session of the United Nations General Assembly, Nov. 10, 1980, was established to provide clean drinking water and sanitation for all by 1990. Achievement of this goal would cut infant mortality in half and revolutionize the role of women in rural areas. At the international level the U.N. provides the overall framework, the technical support, the momentum, and the publicity for this project. Agencies involved are the World Health Organization, World Bank, UNICEF, Food and Agriculture Organization, International Labor Organization, and UNESCO. A steering committee composed of representatives from these groups meets every 3 months. The U.N. Development Program is responsible for collecting and distributing funds. At the national level the Development Program resident representative coordinates all the project's activities within this nation, stimulates the government in the aims of the Decade, provides technical assistance, and works with the diplomatic community. On the local level a total of half a million skilled persons are needed--from PhD hydrologist to pump repairman. Technical training, health education, and community involvement are important goals. A global cost of 20 to 100 billion dollars has been estimated. (Cassar-FRC)
W81-02250

DEVELOPMENTS IN EEC WATER POLICY,
Thames Polytechnic, London (England).
R. C. Denney.
Water Services, Vol 84, No 1015, p S23-S24, September, 1980. 22 Ref.

Descriptors: *Water policy, *Governments, *Regulation, Law enforcement, Water permits, EEC water policy, Future planning, *Europe.

Changes in the EEC water policy during the past two years are reviewed. Increasing concern demonstrated by the European Parliament has had far-reaching effects on EEC water policy. Steps are now underway to determine which member states are not complying with various environmental directives, such as those concerned with the quality of bathing water. Many of the EEC programs are long-term. EEC legislation which is under consideration aims at harmonizing pollution control throughout member states so that no single state will gain an industrial or exporting cost advantage due to inadequate environmental controls. EEC legislation on prevention of water pollution is becoming increasingly more stringent. Legislation is now under consideration, aimed at protecting groundwaters from pollution. Legislation is expected to be passed concerning water pollution by certain industries. (Baker-FRC)
W81-02256

WATER QUALITY MANAGEMENT PLANNING: THE STATE PERSPECTIVE,
Association of State and Interstate Water Pollution Control Administrators, Washington, DC.
R. J. Savage.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 17-21, 1981.

Descriptors: *Water quality management, *Federal government, *State governments, *Local governments, *Nonpoint pollution sources, Water pollution sources, Administration, Planning, Government finance, Governmental interrelations, Legislation, Management, Federal Water Pollution Control Act.

From the viewpoint of the States, it appears that all too often Federal water pollution programs have been a 'revolving carousel of priorities' and management changes rather than reasoned, deliberate, and consistent programs with well defined management and an adequate stable flow of funds. The role of State officials in water quality management is often unclear with Governors being given assignments but little or no implemention authority. Section 208 of the Federal Water Pollution Control Act of 1972 has been an issue since its passage. It took the Environmental Protection Agency (EPA) more than a year and a half after passage to develop program regulation for Section 208 implementation. EPA focused initial efforts on the construction of waste water treatment facilities, which pushed construction ahead of planning. After much conflict and internal trouble, the 208 plan is moving ahead. States and Locals are paying more attention to nonpoint sources and best management practices are being introduced. Several states such as North Carolina, South Carolina, Utah, and Illinois have begun planning programs. Cooperation between officials at all levels is needed to give a possibility of success to water quality programs. (See also W81-02276) (Seigler-IPA)
W81-02279

ENVIRONMENTAL LEGISLATION AND NONPOINT POLLUTION: THE PENNSYLVANIA EXPERIENCE,
Pennsylvania Joint Legislative Air and Water Pollution Control and Conservation Committee, Harrisburg.
L. J. Schweiger.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 22-25, 1981.

Descriptors: *Nonpoint pollution sources, *Pennsylvania, *Water pollution control, *Legislation, Coals, Strip mine wastes, Mine drainage, Coal mine wastes, Acidic water, Urban runoff, Erosion, Regulation, Water law, Water resources development.

After 20 years of significant accomplishments in pollution control and conservation, Pennsylvania will take care in the 1980's to preserve their progress in the face of concerns about energy. A series of legislative actions in the 1960's and 1970's dealt with such areas as solid waste management, air pollution, water pollution, mines and industries, scenic rivers, pesticides, wild resources, and endangered plants. Nonpoint pollution remains Pennsylvania's single largest and most widespread water pollution problem. Approximately 90% of all seriously polluted streams in the State are affected by mine drainage from abandoned mines. The State itself is estimated to have 40% of the entire nation's abandoned mine scars. Despite current laws, erosion from active strip mining is also a problem. Agricultural and urban runoff contribute to the nonpoint source problem. The 1980's will be a difficult period and regulations must be scrutinized to weed out unnecessary requirements. Regulations of the future must be flexible and in proportion to the problem they attempt to solve. (See also 81-02276) (Seigler-IPA)
W81-02280

CONTROL OF TOXICS IN THE UNITED STATES,
Corvallis Environmental Research Lab. OR.
For primary bibliographic entry see Field 5G.
W81-02315

DISTRIBUTION AND CONCENTRATION OF PCB IN THE HUDSON RIVER AND ASSOCIATED MANAGEMENT PROBLEMS,
New York State Dept. of Environmental Conservation, Albany. Bureau of Water Research.
I. G. Carcich, and T. J. Tofflemire.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173825, Price codes: A13 in paper copy, A01 in microfiche.
In: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the Fifth United States-Japan Experts Meeting, Nov. 1979, New Orleans, LA. Environmental Protection Agency Rpt EPA-600/9-80-044, Sep. 1980, p61-86. 6 Fig, 8 Tab, 15 Ref.

Descriptors: *Polychlorinated biphenyls, *Hudson River, *Water quality control, *River beds, *Sediments, Water pollution sources, Toxicity, Economic impact, Dredging, Water pollution, Soil contamination, Pollutants, Sediment control, Environmental effects.

The Hudson River is contaminated with an estimated 640,000 lb of PCB's and a remedial program has been formulated by New York State to cope with this toxic pollutant. Over $3 million has been spent to fully document the extent of PCB contamination in the Upper Hudson River. Over 60% of the PCB's seem to be contained in 40 'hot spot' areas, which have PCB concentrations of over 50 ppm. After evaluating all the decontamination choices, the PCB Reclamation Project was formulated which consists of mechanically or hydraulically dredging the 40 'hot spots' and placing the sediments in an uncapsulated land burial facility. The short and long term environmental impacts are presented for the various decontamination choices. New York is seeking to finance this remedial project through the use of Federal funds, that could be obtained through the Clean Water Act or through special Congressional legislation or through the Superfund Bill, once it is enacted. The PCB Reclamation Project, if funded this spring as is presently anticipated, could be completed by 1982. (Brambley-SRC)
W81-02317

THE SECTION 404 DREDGE AND FILL PROGRAM,
Environmental Protection Agency, Washington, DC.
J. P. Crowder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173825, Price codes; A13 in paper copy, A01 in microfiche.
In: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the Fifth United States-Japan Experts Meeting, Nov. 1979, New Orleans, LA. Environmental Protection Agency Report EPA-600/9-80-044, Sep. 1980, p 87-101. 1 Tab, 6 Ref.

Descriptors: *Water pollution control, *Dredging, *Legislation, *Water quality control, *Navigable waters, Water policy, Recreation, Industrial water, Fisheries, Agriculture, Federal jurisdiction, Disposal, Environmental effects, Testing.

In 1975 the jurisdiction of Section 404 of the Federal Water Pollution Control Act of 1972 was extended to cover all waters subject to use for navigation; recreational use; production of fish and shellfish; production of agricultural products; industrial water supply; or for any other purpose which involves the use of the waters for interstate or foreign commerce purposes. Dredge and fill operations in some waters are subject to section 10 of the 1899 Rivers and Harbors Act supervised by the Army Corps of Engineers, who share supervisory responsiblity for section 404 with the EPA. Section 404 states that consideration must be given to the need for the proposed discharge and the availability of alternative sites and methods of disposal that are less damaging to the environment. Chemical and/or bilogical testing of material proposed for discharge may be required in order to assess the impact of disposal. (Brambley-SRC)
W81-02318

6F. Nonstructural Alternatives

TECHNIQUE FOR ESTIMATING THE MAGNITUDE AND FREQUENCY OF FLOODS IN THE HOUSTON, TEXAS, METROPOLITAN AREA,
Geological Survey, Houston, TX. Water Resources Div.
F. Liscum, and B. C. Massey.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A089 495, Price codes: A03 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations 80-17, April, 1980. 29 p, 2 Fig, 11 Tab, 11 Ref.

Descriptors: *Flood forecasting, *Peak discharge, *Urbanization, *Model studies, Texas, *Urban runoff, Rainfall, Streams, Flow, Flood frequency, Flood recurrence interval, Flood peak, Regression analysis, Estimating, Annual peak discharge, Flood plains, Flood plain insurance, *Houston(TX).

A technique for estimating the magnitude and frequency of floods in the Houston, Tex., metropolitan area was developed by use of a multiple-regression flood-frequency analysis of flow data from unregulated streams in the area. A digital model, relating flood-peak discharge to concurrent rainfall and antecedent soil moisture conditions, was used to simulate 67-year records of annual peak discharges. Flood-frequency characteristics were determined for the simulated annual peaks and for the observed annual peaks at each of 22 gaging-station sites. Relationships applicable to unregulated streams were developed for predicting floods with recurrence intervals of 2, 5, 10, 25, 50, 100, and 500 years. The relationships indicate that as a basin changes from a completely natural state to one of complete urbanization, the magnitude of a 2-year peak discharge is increased by a factor of 4.2, the magnitude of a 50-year peak is increased by a factor of 4.9, and the magnitude of a 100-year peak is increased by a factor of 4.9. (USGS)
W81-02347

FLOOD DEPTH-FREQUENCY RELATIONS FOR LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W81-02349

6G. Ecologic Impact Of Water Development

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, SUMMARY REPORT, FINAL.
Frederiksen, Kamine and Associates, Inc., Sacramento, CA.
Report prepared for Water and Power Resources Service, October, 1980. 89 p, 16 Fig, 6 Tab. 8-07-02-V0035.

Descriptors: *Wildlife management, *Fish management, *Watershed management, *River basin development, California, Land use, Habitat improvement, Chinook salmon, Coho salmon, Steelhead trout, Commercial fishing, Sport fishing, Deer, Road construction, Lumbering, Aquatic habitats, Discharge(Water), Marine fisheries, *Trinity River Basin.

Since completion of the Trinity River Division of the Central Valley Project in California in 1963, salmon and steelhead trout have declined in the river, and physical changes have occurred in the river. The major factors which caused the declines in anadromous fish are: habitat deterioration because of the combined effects of the Trinity Project, logging and associated road building, construction, and elimination of major flood events; overfishing because of the combined catch by ocean and instream fishing; hatchery inefficiencies; and complexities of fishery management. Deterioration of wildlife habitat is attributed to land use, and deer management practices. Restoration and management of king salmon, silver salmon, steelhead trout, and black-tailed deer can be accomplished. Specific production goals and fish harvest regulations that provide for adequate spawning escapement need to be established. Present minimum releases from Lewiston Reservoir are inadequate even if sediment yeilds are reduced. A comprehensive watershed rehabilitation program is required if instream habitat is to be improved. Habitat manipulation for wildlife management should include consideration of both nongame and game species. Based on the findings, a comprehensive management program was formulated, consisting of 14 program actions, none of which can be considered optional or discretionary. (Moore-SRC)
W81-02328

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, MAIN REPORT, FINAL.
Frederiksen, Kamine and Associates, Sacramento, CA.
Report prepared for Water and Power Resources Service, October, 1980. 336 p, 61 Fig, 21 Tab. 8-07-02-V0035.

Descriptors: *Fish management, *Wildlife management, *River flow, *Watersheds, *River basin development, *California, Land use, Environmental effects, Diversion, Chinook salmon, Coho salmon, Steelhead trout, Habitat improvement, Commercial fishing, Sport fishing, Lumbering, Road construction, Construction, Sediments, Fish hatcheries, Deer, *Trinity River Basin.

The management program is to constitute the guide for actions to restore the population of salmon and steelhead from the river, and wildlife of the basin and ultimately through proper management to maintain these at an adopted level. The problems confronting the fish resource consist of: habitat deterioration because of the combined effects of the diversion of 90% of the water originating above Lewiston Dam, logging and associated road building, construction and elimination of major flood events; overfishing because of the combined catch by commercial, sport, and Indian fishing; complexities of management; and hatchery inefficiencies because of inadequate facilities and lack of good biological data. The problem for deer consist of: habitat deterioration because of suppression of wildfires, water impoundments, building, and road construction; and inadequate management. A program to provide for the restoration and long-range management of the fish and wildlife resources of the basin is proposed, consisting of the following 14 actions: establish institutional organization; regulate catch; rehabilitate and maintain tributaries in the upper Trinity River; rehabilitate watersheds; rehabilitate Grass Valley Creek Watershed; set criteria for roads and general construction; remove river sand and modify channel; monitor fishery and operations; monitor stream conditions; restrict floodplain development; monitor land use; manage fish production; formulate a comprehensive wildlife management program; and conduct wildlife habitat manipulation program. (Moore-SRC)
W81-02329

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, APPENDIX A, SOCIOECONOMIC ANALYSIS, FINAL.
Frederiksen, Kamine and Associates, Sacramento, CA.
Report prepared for Water and Power Resources Service, October, 1980. 156 p, 8 Fig, 35 Tab, 39 Ref. 8-07-02-V0035.

Descriptors: *Economic impact, *Social impact, *Fish management, *Wildlife management, *California, *River basin development, Land use, Indian reservation, Lumbering, Agriculture, Irrigation, Commercial fishing, Sport fishing, Discharge(Water), Water resources, *Trinity River Basin.

A demographic profile is presented for Trinity County and a portion of Humboldt County, California, which are located in the Trinity River Basin. The lumber industry is the main industry in

Trinity County, but it is being hurt by the limited amount of forestlands available. Recreation related tourism is another mainstay of the economy, but it has been depressed for the past several years. The primary economic problem is unemployment, which is particularly severe during the winter months because the lumber industry and recreation are seasonal. Forestlands constitute the predominant land use, with more than 90% of the land in forests. Other major land uses are: recreation, agriculture, housing, mining, and roads. As part of the fish and wildlife management program proposed for the Trinity River Basin, minimum flow release schedules for the Trinity River Project may be modified, and modification will affect the Central Valley Project. The relative value of economic trade-offs that will result from increasing water releases to the Trinity River was estimated for the irrigation, power and energy, and fisheries sectors. The economic impact to the agriculture sector and the power sector will be negative for increases in releases to the river. The sports and commercial fishery instream and in the ocean should benefit from increases in water releases. The Indian subsistence fishery has cultural values beyond simply the food value, and thus it is difficult to assign an economic value to it. (Moore-SRC)
W81-02330

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, APPENDIX B, SEDIMENT AND RELATED ANALYSIS, FINAL.
Frederiksen, Kamine and Associates, Sacramento, CA.
Report prepared for Water and Power Resources Service, October, 1980. 345 p, 45 Fig, 56 Tab, 8-07-02-V0035.

Descriptors: *Aquatic habitat, *Sediment yield, *River basin development, *California, Anadromous fish, *Sediment control, Hydrology, Sedimentation rates, River flow, Watershed management, Environmental effects, *Trinity River Basin.

The flow characteristics of the Trinity River in California has been affected by the Trinity River Project which was made operational in 1963. Since then, approximately 90% of the average annual runoff upstream of Lewiston has been diverted out of the Trinity River Basin. Pre-project and post-project hydrological changes, overall visual changes in river regime, sediment sources and yields, and components of the river regime considered to be most important to anadromous fish habitat were evaluated. The present flow conditions at Lewiston and the present excessive subbasin sediment yields have negatively impacted some aspects of the anadromous fish habitat, and the negative impacts will continue. The greatly reduced mean annual water discharges and the large volume of sediment entering the Trinity River system have degraded the usefulness of many pool and riffle areas. Any remedial actions must include extensive watershed management to reduce the amount of sediment entering the river. With the reduction of present sediment yields, maintenance of pool areas would be possible through either one or a combination of Lewiston flushing releases and debris dams on major sediment producing tributaries. Under present flow conditions, the occurrence of flows with sufficient magnitude to initate riffle bed movement has been elimiated from Lewiston Dam to Grass Valley Creek, and the frequency of such flows has been drastically reduced to the North Fork. (Moore-SRC)
W81-02331

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, APPENDIX C, FISH AND WILDLIFE ANALYSIS, FINAL, VOLUME 1.
Frederiksen, Kamine and Associates, Sacramento, CA.
Report prepared for Water and Power Resources Service, October, 1980. 389 p, 53 Fig, 65 Tab. 8-07-02-V0035.

Descriptors: *Fish management, *Anadromous fish, *Aquatic habitat, River flow, *California, Chinook salmon, Coho salmon, Steelhead trout, Environmental effects, Fish populations, Habitat improvement, Diversion, Sediments, River basin development, Fish hatcheries, Commercial fishing, Sport fishing, Land use, *Trinity River Basin.

As part of an effort to define and correct the fish resource declines in the Trinity River Basin, California, attributable to the Trinity River Division, Central Valley Project and to other causes, fish resources within the basin are examined and changes that have occurred over time are identified. The anadromous fish of principal interest include the king salmon, silver salmon, and steelhead trout. Major factors which are found to affect fish populations include: both sport and commercial fishing in the ocean; sport fishing and Indian fishing instream, habitat deterioration since construction of the Trinity River Project; land use changes; predation; fish culture and hatchery operations. The main items affecting the fish habitat in the upper Trinity River include: closure of the river at Lewiston, changed flow regime, changed temperature regime, continual or increased sediment production, changed channel configuration, and changed substrate. The effects of alternative flow release schedules on trout and salmon habitat are evaluated in terms of costs and benefits. The recommended management option for fish production consists of 50% artifical production below Lewston Dam, a total annual release of about 260,000 acre-feet of water, and allowable harvest of 11,900 king salmon in spring, 148,000 to 155,000 in fall, 10,100 silver salmon, 32,500 adult steelhead, and 30,000 half-pounders. Modifications in fish culture technology and hatchery facilities are recommended, including timing and size of release, construction of release ponds, diet, and hatchery environment. (Moore-SRC)
W81-02332

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANGEMENT PROGRAM, APPENDIX C, FISH AND WILDLIFE ANALYSIS, FINAL, VOLUME 2.
Frederiksen, Kamine and Associates, Sacramento, CA.
Report prepared for Water and Power Resources Service, October, 1980. 358 p, 11 Fig, 39 Tab, 530 Ref., est. 8-07-02-V0035.

Descriptors: *Invertebrates, *Wildlife, *Fish management, *Aquatic populations, Fish food organisms, *California, Benthos, Aquatic habitat, Wildlife management, Habitat improvement, Silting, Low flow, River flow, Streambeds, Bottom sediments, *Trinity River Basin.

The Trinity River flow regime was significantly altered by the construction of Lewiston and Trinity Dams and since their construction the river has been subjected to heavy siltation. Changing flows and siltation can adversely affect aquatic invertebrate populations and subsequent fish production. A comparative study of the benthic organisms of the Trinity River System and the Smith River was carried out using a Surber sampler and a screen sampler, and fish stomach contents were analyzed. The Smith and Trinity systems are comparable in benthic population type and density, and similar in bottom structure, sand, gravel and boulder size. The variability in benthic population density from the lower Trinity and Smith Rivers to the upper Trinity seems to be due to altitudinal differences. The benthic fauna production capability of the Trinity River systems is good when compared with the Smith River and North Fork, which have not been as adversely impacted by diversions and siltation. Increased benthic populations in the Trinity River above the North Fork should be very responsive to the cleansing of the substrate. Wildlife problems in the Trinity River Basin appear to be associated with both habitat deficiencies and policy matters. The habitat problems stem from the loss of land resulting from the inundation of more than 20,000 acres to create the reservoirs. A comprehensive wildlife management program including a habitat manipulation and management plan, should be developed and implemented for the entire Trinity River basin. (Moore-SRC)
W81-02333

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, APPENDIX D, DRAFT REPORT COMMENTS AND RESPONSES, FINAL, VOLUME 1.
Frederiksen, Kamine and Associates, Sacramento, CA.
Report prepared for Water and Power Resources Service, October, 1980. 559 p. 8-07-02-V0035.

Descriptors: *Fish management, *Wildlife management, *Habitat improvement, *Water resources, *California, Aquatic habitat, Land management, Instream flows, *Trinity River Basin, Economics, River flows, Diversion.

The comments of the Trinity River Basin Fish and Wildlife Task Force on the Draft Report on the Proposed Trinity River Basin Fish and Wildlife Management Program and the responses by the contractor are presented. The Task Force consists of the following agencies which have land or natural resources management responsibilities in the Trinity River Basin in California: Water and Power Resources Service; Fish and Wildlife Service; Bureau of Land Management; Bureau of Indian Affairs; Soil Conservation Service; Forest Service; National Marine Fisheries Service; Department of Water Resources; California Department of Fish and Game; State Water Resources Control Board; Trinity County; Humboldt County; Hoopa Valley Tribe. Major points of disagreement include the following: recommended instream flows; organizational structure; fishery problems; construction of a debris dam on Grass Valley Creek; logging practices; the study of wildlife problems; and the economic values for water diverted to the Central Valley, and for fish. (Moore-SRC)
W81-02334

PROPOSED TRINITY RIVER BASIN FISH AND WILDLIFE MANAGEMENT PROGRAM, APPENDIX D, DRAFT REPORT COMMENTS AND RESPONSES, FINAL, VOLUME 2.
Frederiksen, Kamine and Associates, Sacramento, CA.
Report prepared for Water and Power Resources Service, October, 1980. 364 p. 8-07-02-V0035.

Descriptors: *Fish management, *Wildlife management, *Water resources, *Habitat improvement, *California, Land management, River flows, Economics, Diversion, *Trinity River Basin.

The comments of other Federal, state and local agencies and organizations and individuals on the Draft Report on the Proposed Trinity River Basin Fish and Wildlife Management Program and the responses from the contractor are presented. Federal agencies include: National Fisheries Research Center; Department of the Air Force; Army Corps of Engineers, San Francisco District; Federal Highway Administration, Region 9; Environmental Protection Agency, Region IX; Bureau of Mines; Geological Survey; Department of Energy, Western Area Power Administration. The California Resources Agency, and the California Department of Forestry, and the City of Redding made comments in writing, as did ten organizations, two private corporations, and 12 individuals. A transcript of the public involvement meeting in Weaverville, California on 19 April 1980 is included. (Moore-SRC)
W81-02335

7. RESOURCES DATA

7A. Network Design

SAMPLING, PRESERVATION, AND ANALYSIS OF SEDIMENT SAMPLES: STATE-OF-THE-ART LIMITATIONS,
State Univ. of New York Coll. at Buffalo. Great Lakes Lab.
R. H. Plumb, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173825, Price codes: A13 in paper copy, A01 in microfiche.
In: Management of Bottom Sediments Containing

Group 7A—Network Design

Toxic Substances, Proceedings of the Fifth United States-Japan Experts Meeting, Nov., 1979, New Orleans, LA. EPA Report EPA-600/9-80-044, Sep., 1980, p 259-272. 2 Fig, 2 Tab, 17 Ref. R805885010.

Descriptors: *Sediments, *Sampling, *Analytical techniques, *Testing procedures, Water quality standards, Water quality control, Dredging, Preservation, Hydrology, Water resources, Decision making, Regulation, Sediment control.

Increasing regulatory concern over the effects of sediments on water quality will require expanded sediment sampling, and standardized methods of sediment collection, sample handling and analysis to insure comparability of data. This paper presents a procedure based on an awareness of the interrelated nature of the decisions to be made. The first step in the approach is an explicit statement of the purpose of the study so that testing procedures can be selected that are the most efficient and simplify the selection of sample handling and storage requirements. Selection of sample collection techniques and locations is the most difficult area to provide definitive guidance because of the importance of point sources, local hydrology, study purposes, and financial resources. Bias that can be introduced as a result of collection and location decisions is discussed. By being aware of the present limitations of available sampling techniques and analytical procedures, project managers can define the best sampling program for their specific need. (Brambley-SRC)
W81-02325

7B. Data Acquisition

RESISTANCE OF NUTRIENT CYCLING SYSTEMS TO PERTURBATIONS OF THE FLOW RATES,
Georgia Univ., Athens. Dept. of Mathematics.
G. W. Harrison, and S. Fekete.
Ecological Modelling, Vol 10, p 227-241, August, 1980. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Flow rates, *Nutrients, Equilibrium, Model studies, Mathematical models, Pollutants, *Ecosystems.

A linear model is used to measure the resistance of a nutrient system to changes in flow rates. This is applicable to situations such as continual harvesting, drought, and gradual discharge of pollutants rather than catastrophic events such as floods or dumping pollutants. The theory was tested on 8 hypothetical ecosystems: tundra, grassland, temperate forests, tropical forests, ocean, lake, salt marsh, and stream. Some of the hypotheses obtained were: (1) The ratio of the net imbalance in the perturbed flow rates to the total outflow determines the ultimate displacement of nutrient levels relative to their original equilibrium levels. (2) The rate of displacement caused by a small disturbance in flow rate is about the same as the rate of return following a perturbation of the nutrient concentrations. (3) The rate of displacement is measured by eigenvalues, which are greater at high flow rates and fast turnover times. (4) The critical root is approximately total outflow divided by total nutrients in systems with relatively small outflows. (5) Aquatic systems have faster response rates than terrestrial systems. (6) Any terrestrial system which has been disturbed within the last 1,000 years may not be in equilibrium; therefore it cannot be assumed that inflows and outflows are in balance. (Cassar-FRC)
W81-02258

EVALUATION OF A DISTRIBUTED PARAMETER AND A LUMPED PARAMETER MODEL FOR USE IN WATER QUALITY MODELING
Maryland Univ., College Park. Dept. of Agricultural Engineering.
M. Yarmanoglu, J. E. Ayars, and G. K. Felton.
In: Nonpoint Pollution Control -- Tools and Techniques for the Future, Proceedings of a Technical Symposium, p 119-128, 1981. 7 Fig, 7 Ref.

Descriptors: *Hydrographs, *Model studies, *Water quality, *Mathematical models, Estimating, Flow characteristics, Cultivation, Land use, Planting management, Soil management, Erosion, Watersheds(Basins), Computer models, Storm runoff.

A comparison of a Distributed Parameter Model (DPM) for simulating hydrographs from natural watersheds and the University of Maryland version of the USDAHL model, a quasi-lumped continuous simulation model, shows that the DPM does a better job of simulating storm hydrographs. DPM, a distributed parameter watershed model, has three main components: overland flow, subsurface flow, and channel flow. DPM uses the finite element method with kinematic wave approximations to solve one-dimensional flow equations. USDAHL treats a watershed as a topographical sequence of response zones. Its two main components are overland flow and subsurface flow. DMP is basically a research model while USDAHL is an applications oriented model. Both models, were applied to two research watersheds, one with conventional tilling and one with 'no-till'. DPM has a high degree of simulation accuracy which justifies its relatively high computing costs. The use of DPM to simulate storm hydrographs from within the USDAHL would combine the advantages of both models. (See also W81-02276) (Seigler-IPA)
W81-02292

PREDICTABILITY OF CHANGE IN SOIL REFLECTANCE ON WETTING,
Purdue Univ., IN. Water Resources Research Center, Lafayette, IN.
J. B. Peterson, B. F. Robinson, and R. H. Beck.
In: Machine Processing of Remotely Sensed Data Symposium, p 264-273, 1979. Institute of Electrical and Electronic Engineers, 345 East 47th St, NY. Catlog No 79 Ch 1430-8 MPRSD. Symposium held June 27-29, 1979, Purdue University, West Lafayette, Indiana. OWRT-A-061-IND(1).

Descriptors: *Soil moisture, *Moisture tension, Forecasting, *Remote sensing, *Reflectance, Soil water, Wetting, Soil wetting, Soil reflectance.

The loss of reflectance from the oven dry state to field capacity for 15 surface soils from Central Indiana, representative of the Mollisol and Alfisol great soil groups, is definitely related to the oven dry reflectances of the soils. A regression analysis of the relationship of the darkening effect of wetting on the reflectance of the soils when dry results in regression curves with R super 2 values ranging from .9914 to .9291 over the five wavelength bands used, .52-.58 mu, .71 mu, .76-.90 mu, .90-1.22 mu and 1.50-1.73 mu. Furthermore, striking evidence of the predictability of soil moisture tensions from reflectance data was noted when the regression curves at .71 mu were run for the reflectance values of the 15 soils at 15 bar and 1/3 bar against their reflectances when oven dry. When the reflectances at 15 bar were plotted against those of the same samples when oven dry an R super 2 of 0.95 was found. Similarly, when data for reflectances of the 15 soils at 1.3 bar were plotted against the oven dry reflectances, an R super 2 of .96 was computed. This evidence strongly supports the thesis that moisture tensions of soils can be predicted from reflectance measurements.
W81-02313

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1979--VOLUME 2A. SOUTH FLORIDA SURFACE WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-183485, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-79-2A, December, 1980. 688 p, 14 Fig, 1 Tab, 9 Ref.

Descriptors: *Florida, *Hydrologic data, *Surface waters, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Data collections, Sites, *South Florida.

Water resources data for the 1979 water year for south Florida include continuous or daily discharge for 83 streams, periodic discharge for 5 streams, peak discharge for 3 streams, continuous or daily stage for 51 streams and periodic stage for 38 streams; continuous elevations for 15 lakes and periodic elevations for 6 lakes; and quality of water for 183 surface water sites. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (USGS)
W81-02341

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1979--VOLUME 2B. SOUTH FLORIDA GROUNDWATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-183493, Price codes: A24 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-79-2B, December 1980. 558 p, 18 Fig, 1 Tab, 9 Ref.

Descriptors: *Florida, *Hydrologic data, *Groundwater, *Water quality, Water analysis, Water temperature, Chemical analysis, Water wells, Water levels, Data collections, Sites, *South Florida.

Water resources data for the 1979 water year for south Florida include continuous groundwater levels for 192 wells, periodic groundwater levels for 808 wells, and quality of water for 358 wells. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State, and Federal agencies in Florida. (USGS)
W81-02342

CHEMICAL ANALYSES FOR SELECTED WELLS IN SAN JOAQUIN COUNTY AND PART OF CONTRA COSTA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
G. L. Keeter.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $9.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-420, 1980. 70 p, 3 Fig, 50 Maps, 3 Tab.

Descriptors: *Chemical analysis, *Groundwater, *Water wells, *California, Water chemistry, Well data, *San Joaquin Valley(CA), *San Joaquin County(CA), *Contra Costa County(CA).

The study area of this report includes the eastern valley area of Contra Costa County and all of San Joaquin County, an area of approximately 1,600 square miles in the northern part of the San Joaquin Valley, Calif. Between December 1977 and December 1978, 1,489 wells were selectively canvassed. During May and June in 1978 and 1979, water samples were collected for chemical analysis from 321 of these wells. Field determinations of alkalinity, conductance, pH, and temperature were made, and individual constituents were analyzed. This report is the fourth in a series of baseline data reports on wells in the Sacramento and San Joaquin Valleys. (USGS)
W81-02343

SIMULATION OF WATER-QUALITY DATA AT SELECTED STREAM SITES IN THE MISSOURI RIVER BASIN, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
J. R. Knapton, and M. A. Jacobson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-125023, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-76, September, 1980. 30 p, 2 Fig, 4 Tab, 5 Ref.

Descriptors: *Water quality, Hydrologic data, *Model studies, *Missouri River, *Montana, Simulation analysis, Specific conductivity, Simulated solute concentrations.

Modification of sampling programs at some water-quality stations in the Missouri River basin in Montana has eleminated the means by which solute loads have been directly obtained in past years. To compensate for this loss, water-quality and streamflow data were statistically analyzed and solute loads were simulated using computer techniques. Functional relationships existing between specific conductance and solute concentration for monthly samples were used to develop linear regression models. The models were then used to simulate daily solute concentrations using daily specific conductance as the independent variable. Once simulated, the solute concentrations, in milligrams per liter, were transformed into daily solute loads, in tons, using mean daily streamflow records. Computer output was formatted into tables listing simulated mean monthly solute concentrations, in milligrams per liter, and the monthly and annual solute loads, in tons, for water years 1975-78. (USGS)
W81-02346

HYDROLOGIC MONITORING PROGRAM IN ELDRIDGE-WILDE AND EAST LAKE ROAD WELL-FIELD AREAS, PINELLAS AND HILLSBOROUGH COUNTIES, FLORIDA, 1978,
Geological Survey, Tallahassee, FL. Water Resources Div.
L. R. Mills.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1195, 1980. 23 p, 15 Fig, 4 Tab, 9 Ref.

Descriptors: *Hydrologic data, *Monitoring, *Saline water-freshwater interface, *Florida, *Observation wells, Water levels, Pumping, Drawdown, Regulation, Groundwater, Aquifers, Rainfall, Water table, Potentiometric level, Water quality, Chlorides, *Floridan aquifer, Pinellas County(FL), Hillsborough County(FL), Well fields.

This report describes the observation-well network in Eldridge-Wilde and East Lake Road well-field areas, Pinellas and Hillsborough Counties, Florida. Data obtained in 1978 from the network in and adjacent to the two well fields, as well as rainfall and pumpage records, are presented. The Southwest Florida Water Management District has established regulatory water-level limits in four observation wells and water-quality limits in three observation wells. Water levels dropped below regulatory limits in the spring of 1978 in three wells. Chloride concentrations in 1978 remained above regulatory limits for the entire year in one well and exceeded the limit during the late spring in the other two deep wells, both west of Eldridge-Wilde well field. (USGS)
W81-02350

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1979,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02353

APPROXIMATE LAND-SURFACE SUBSIDENCE IN THE HOUSTON-GALVESTON REGION, TEXAS, 1906-78, 1943-78, AND 1973-78,
Geological Survey, Houston, TX. Water Resources Div.
R. K. Gabrysch.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $1.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-338, March, 1980. 3 Fig, 1 Ref, 3 Sheets.

Descriptors: *Maps, *Land subsidence, *Groundwater, *Aquifers, *Texas, Compaction, Harris County(TX), Artesian pressures, Water-level declines.

This report consists of three maps that show approximate land-surface subsidence in the Houston-Galveston region, Texas, during the periods 1906-78, 1943-78, and 1973-78. The data, which are based on releveling by the National Geodetic Survey, show that subsidence has accelerated in the western part of Harris County. (USGS)
W81-02355

HYDROGEOLOGIC DATA FOR SOUTH CENTRAL CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
F. P. Haeni, and H. R. Anderson.
Connecticut Department of Environmental Protection Water Resources Bulletin No 32, 1980. 43 p, 3 Fig, 2 Tab, 4 Ref, 1 Plate.

Descriptors: *Groundwater resources, *Water wells, Data collections, *Well data, *Connecticut, Hydrogeology, Aquifer characteristics, Water yield, Test wells, Water levels, *Hydrologic data, Drillers logs, Geophysics, Porosity, Velocity, Hydrographs, Maps, *South-central Connecticut.

Subsurface hydrogeologic data for selected stratified-drift aquifers in south-central Connecticut was collected during the period 1974 to 1980, as part of a program to determine their water-yielding potential. This report includes: (1) Geologic logs, describing the aquifer materials in 233 test holes and 18 test wells, (2) the interpretation of three, seismic refraction profiles, one of which indicates that the stratified drift may be as much as 425 feet thick in Plainville, Conn., (3) hydrographs showing water-level fluctuations in 11 observation wells, and (4) the porosites and compressional velocities of fifteen core samples of Triassic-Jurassic sedimentary rocks that underlie the stratified drift. (USGS)
W81-02356

HYDROGEOLOGY OF THE TOWN OF NORTH HEMPSTEAD, NASSAU COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02357

PRINCIPAL AQUIFERS AND WELL YIELDS IN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
D. Molenaar, P. Grimstad, and K. L. Walters.
Washington Department of Ecology, Geohydrologic Monograph 5, 1980. 38 Ref, 1 Sheet.

Descriptors: *Groundwater, *Aquifers, *Water wells, *Water yield, *Washington, Aquifer characteristics, Basalts, Sedimentary rocks, Glacial drift, Alluvium, Maps.

The principal aquifers supplying water to wells in Washington State are (1) basalt and associated sedimentary interbeds of the Columbia River Basalt Group of Miocene age, (2) sedimentary deposits of Miocene to early Pleistocene age, (3) glacial drift of Pleistocene age, and (4) alluvium of Quaternary age. Yields of wells tapping these aquifers range from a few gallons per minute to more than 3,000 gal/min (gallons per minute) from the basalt and alluvium, to 1,000 gal/min from the sedimentary deposits, and as much as 10,000 gal/min from the glacial drift. (USGS)
W81-02358

GROUNDWATER DATA, 1969-77, VANDENBERG AIR FORCE BASE AREA, SANTA BARBARA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
C. E. Lamb.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $9.50 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 80-736, June, 1980. 50 p, 3 Fig, 2 Tab, 6 Ref, 1 Plate.

Descriptors: *Groundwater resources, *Water wells, Pumping, *Water yield, *Water levels, *Water quality, Chemical analysis, Water analysis, Data collections, Water level fluctuations, California, *San Antonio Valley(CA), *Santa Barbara County(CA), Lompoc Plain(CA), *Vandenberg Air Force Base(CA).

The water supply for Vandenberg Air Force Base is obtained from wells in the Lompoc Plain, San Antonio Valley, and Lompoc Terrace groundwater basins. Metered pumpage during the period 1969-77 from the Lompoc Plain decreased from a high of 3,670 acre-feet in 1969 to a low of 2,441 acre-feet in 1977, while pumpage from the San Antonio Valley increased from a low of 1,020 acre-feet in 1969 to a high of 1,829 acre-feet in 1977. Pumpage from the Lompoc Terrace has remained relatively constant and was 187 acre-feet in 1977. In the Barka Slough area of the San Antonio Valley, water levels in four shallow wells declined during 1976 and 1977. Water levels in observation wells in the two aquifers of the Lompoc Terrace ground-water basin fluctuated during the period, but show no long term trends. Chemical analyses or field determinations of temperature and specific conductance were made of 219 water samples collected from 53 wells. In the Lompoc Plain the dissolved-solids concentration in all water samples was more than 625 milligrams per liter, and in most was more than 1,000 milligrams per liter. The manganese concentration in analyzed samples equaled or exceeded the recommended limit of 50 micrograms per liter for public water supplies. Dissolved-solids concentrations increased with time in water samples from two wells east of the Air Force Base in San Antonio Valley. In the base well-field area, concentrations of dissolved solids ranged from 290 to 566 milligrams per liter. Eight analyses show manganese at or above the recommended limit of 50 milligrams per liter. In the Lompoc Terrace area dissolved-solids concentrations ranged from 470 to 824 milligrams per liter. Five new supply wells, nine observation wells, and two exploratory/observation wells were drilled on the base during the period 1972-77. (USGS)
W81-02359

DRAINAGE AREAS OF SELECTED SURFACE-WATER SITES IN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. W. Foose.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $11.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-957, 1980. 81 p, 1 Fig, 3 Tab, 3 Ref.

Descriptors: *Drainage areas, *Surface waters, *Florida, *Streams, *Lakes, Sites, Hydrologic data.

Drainage areas for about 1,500 surface-water sites on streams and lakes in Florida are contained in this report. Sites are described in relation to a nearby city or town, and are located by county, by latitude-longitude, and by topographic map on which it is located. In addition, the surface areas of lakes are shown for the elevation given on the topographic map. These data were retrieved from the Surface Water Index developed and maintained by the Hydrologic Records Section of the Florida District office of the U.S. Geological Survey.
W81-02371

POTENTIOMETRIC SURFACE MAP OF WATER IN THE MADISON GROUP, MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
R. D. Feltis.
Available from the Mont. Bureau of Mines and Geology, Butte, Mont., Price: $2.50 in paper copy. Montana Bureau of Mines and Geology Hydrogeologic Map 2, 1980. 1 Sheet, 1 Ref.

Descriptors: *Maps, *Potentiometric level, *Geohydrologic units, *Groundwater, *Montana, Water levels, Hydrogeology, Carbonate rocks, Deep wells, Hydraulic gradient, Madison Group (MT).

The configuration of the potentiometric surface of water in the Madison Group, of Mississippian age, is shown by contours on a base map at a scale of 1:1,000,000. The map is one of a series of maps produced as part of a regional study of the geohydrology of the Madison Group in Montana. Other maps in the series show the general quality of water in the Madison aquifer at a scale of 1:1,000,000 and the configuration of the top of the Madison Group at a scale of 1:250,000. The configuration map shows that the hydraulic gradient is away from the principal recharge areas in several mountain ranges and toward the northwestern, north-central and northeastern parts of the State. Data are from oil tests or production wells, water wells, and springs. The altitude of the potentiometric surface at most sites was calculated from oil well drill-stem-test data. The data range in age from 1940 to 1977. (USGS)
W81-02374

SUMMARY GROUNDWATER RESOURCES OF CENTRE COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
C. R. Wood.
Pennsylvania Department of Environmental Resources, Harrisburg. Water Resources Report 48, 1980. 60 p, 5 Fig, 1 Plate, 7 Tab, 62 Ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Hydrogeology, *Water yield, *Pennsylvania, Water quality, Well data, Water levels, Petrology, Drawdown, Groundwater recharge, Water analysis, Water wells, Surface groundwater relationships, Centre County(PA).

The northwest third of Centre County, Pa., lies in the Appalachian Plateaus physiographic province. The principal aquifers are the Allegheny Group, Pottsville Group, and Burgoon Sandstone. The average yield of nondomestic wells is 20 gal/min (gallons per minute) in the Allegheny, 100 gal/min in the Pottsville, and 70 gal/min in the Burgoon. Water from the Allegheny and Pottsville Groups is commonly high in iron. The southeast two-thirds of the county lies in the Appalachian Mountain section of the Valley and Ridge physiographic province. The average yield of nondomestic wells is less than 100 gal/min from most of the 33 formations in this section. However, average yields of 200 gal/min or more can be obtained from the Old Port, Keyser, Tonoloway, Wills Creek, Nittany, and Gatesburg Formations. The water occurs in fractures, solution-enlarged in carbonate rocks. Thus, the noncarbonate rocks are susceptible to overpumping, and the carbonate-rock aquifers are easily contaminated. At least 10 springs have average discharges in excess of 1,000 gal/min. Wells along fracture traces generally have much higher yields than those off the fracture traces. Wells in valleys generally have higher yields than those on hillsides and hilltops. (USGS)
W81-02375

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN MISSOURI--FISCAL YEAR 1980.
Geological Survey, Rolla, MO. Water Resources Div.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $8.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1019, August, 1980. 64 p, 2 Fig, 5 Tab, (Compiled by Kratzer, W. M.).

Descriptors: *Water resources, *Projects, Programs, *Water quality, *Missouri, Publications, *Streamflow, Bibliographies, Data collections, Sites, Hydrologic data, Networks, Gaging stations, Crest-stage gages, Low flow, Urban runoff, Reviews, Rainfall, Runoff, Flow rates, Low flow.

Water-resources investigations of the U.S. Geological Survey in Missouri consist of collecting hydrologic data and conducting interpretative investigations. The data and the results of the investigations are published or released by either the U.S. Geoloogical Survey or by cooperating agencies. The report describes the data-collection activities and investigations in Missouri for the 1980 fiscal year and provides an extensive list of water-resources references for the State. (USGS)
W81-02379

RECONNAISSANCE OF GROUNDWATER IN THE VICINITY OF GUNNISON AND CRESTED BUTTE, WEST-CENTRAL COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-02381

QUALITY OF WATER IN THE PEARL RIVER, JACKSON TO BYRAM, MISSISSIPPI, SEPTEMBER 21-22, 1976,
Geological Survey, Jackson, MS. Water Resources Div.
G. A. Bednar.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $5.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-575, 1980. 36 p, 6 Fig, 2 Tab, 14 Ref.

Descriptors: *Water quality, *Data collections, *Streamflow, *Water resources, *Mississippi, Surface waters, Low flow, Water utilization, Water analysis, Water properties, Bacteria, Water pollution, Pesticides, Hydrologic data, *Pearl River(MS), Hinds County(MS), Rankin County(MS).

The Pearl River in Mississippi, entering the study reach at site 1 at Jackson, was generally higher in dissolved-oxygen concentrations and lower in dissolved-solids, nutrients, and biochemical oxygen demands than at site 13 at Byram 11.8 miles downstream of site 1 and about 11 river miles downstream of treated sewage inflow. The dissolved oxygen concentrations of the water ranged from 6.4 to 7.8 milligrams per liter at site 1, and from 4.9 to 7.4 milligrams per liter at site 13. The average dissolved-solids concentrations were 60 and 97 milligrams per liter at sites 1 and 13, respectively. The average dissolved-solids load increased downstream about 35 tons per day. The average loads of 5-day biochemical oxygen demand, total phosphorus, and ammonia increased downstream about 2, 0.7, and 0.6 tons per day, respectively. The water in the study reach contained color, total iron, and manganese concentrations that exceeded limits recommended for public water supplies. Trace amounts of some pesticides and minor elements were present in both the water and bottom material at sites 1 and 13. The concentrations of most dissolved constituents were below recommended limits during the study and the Pearl River in the study reach may be considered usable for many purposes. (USGS)
W81-02392

SUMMARY OF WATER-QUALITY DATA FOR SELECTED STREAMS IN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
M. W. Gaydos.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $23.25 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 80-682 (WRI), 1980. 148 p, 9 Fig, 2 Tab, 7 Ref, 2 Plates.

Descriptors: *Water quality, *Data collections, *Rivers, *Colorado, Surface waters, Sampling, Sites, Regression analysis, Chemical analysis, Inorganic compounds, *Trace elements, Nutrients, Specific conductivity.

This report presents the first statewide summary of water-quality data for selected streams in Colorado. Included in the report are a tabulation of the 165 surface-water-sampling sites for which five or more analyses of major chemical constituents were available at the end of the 1978 water year and a tabulation of the types--major chemical constituents, trace or minor elements, biological constituents, pesticides, or radio-chemicals--and number of water-quality analyses available at each of the 165 sites. Also included are statistical summaries, including regression summaries showing the relation between specific conductance and major chemical constituents, for 117 sites for which 20 or more analyses of major chemical constituents are available. Examples of linear-regression plots of specific conductance and selected major chemical constituents based on data from the Eagle River at Gypsum, Colo., are presented. Decisions to modify the frequency of collection or the types of constituents determined at many sites are facilitated by the statistal summaries. (USGS)
W81-02394

8. ENGINEERING WORKS

8A. Structures

RIVER SEVERN SUPPLY SCHEME - DEVELOPMENT OF UPTON INTAKE WORKS,
Water Services, Vol 84, No 1015, p 561-563, September, 1980. 3 Fig.

Descriptors: *Severn River, *Severn Trent Waterway, *Intakes, Hydraulic structures, Engineering structures, Pumps, Intake structures, *Water supply, *England, Coventry area.

The River Severn Scheme for water source control is divided into five major components: Upton intake works, Strensham Treatment Works, River Severn pipeline, Henley in Arden booster station, and Meriden service reservoirs. The Upton Intake Works forms the foundation of the whole system and is described in depth, with information offered concerning the River Severn, the intake structure, the tunnel and the sump. At peak demands high abstraction rates were seen to draw the water level down dangerously near to the minimum pumping level, indicating that proposed increases in the quantity of water could not be met by the existing intake works. During a recent study areas of high head losses were identified, and modifications were undertaken to increase the maximum possible abstraction rate. With the changes the complete flow system, including the intake structure with new bandscreens, tunnel and the existing sump, was able to sustain a throughput in the region of 200 million liters/day. The abstraction rate was now limited by the physical size of the pumps. Changes in the pumps themselves allowed the capacity of the system to be increased. (Baker-FRC)
W81-02257

CONTAINMENT AREA DESIGN FOR SEDIMENTATION OF FINE-GRAINED DREDGED MATERIAL,
Army Engineers Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
R. L. Montgomery.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173825, Price codes: A13 in paper copy, A01 in microfiche. In: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the Fifth United States-Japan Experts Meeting, Nov 1979, New Orleans, LA. Environmental Protection Agency Rpt EPA-600/9-80-044, Sep 1980, p 229-257. 13 Fig, 2 Tab, 9 Ref.

Descriptors: *Sediments, *Dredging, *Water quality control, *Water quality standards, Waste disposal, *Settling basins, Suspended solids, Ponding, Flocculation, Particle size, Sediment load, Organic matter, Specific gravity, Physical properties.

Procedures are developed for designing fine-grained dredged material sedimentation basins to provide adequate retention of suspended solids so that required effluent suspended solids levels can be met. Separate design procedures for freshwater and saltwater sediments provide for determination of the respective surface area or detention time required to accommodate continuous dredged material disposal. Procedures are also given for esti-

mation of the storage volume required for a single disposal activity and the corresponding ponding depths, freeboard requirements, and dike heights. Laboratory tests required to obtain data for sediment charactarization, containment area design, and estimates of long term storage capacity are described. These tests include salinity determination of near bottom water and natural water content, Atterburg limits, organic content, specific gravity, and grain size analysis of the sediments. Flocculent setting tests, generally applicable to freshwater sediments, are described. (Brambley-SRC)
W81-02324

8B. Hydraulics

DYNAMIC-WAVE MODELING OF STORM SEWERS WITH SURCHARGE.
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
N. Pansic.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-182206, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, 1980. 102 p, 45 Fig, 12 Tab, 11 Ref. OWRT-A-086-ILL(3), 14-31-0001-9015.

Descriptors: Computer models, Conduit flow, Drainage systems, Flood routing, *Storm sewers, Hydraulics, Hydrographs, Mathematical models, Open-channel flow, *Dynamics, *Sewers, Sewer systems, *Storm drains, Storm runoff, *Unsteady flow, Urban drainage.

Although storm sewers are normally designed for open-channel flow, the sewers may flow under pressure, i.e. surcharge, for a number of reasons. This study investigates the surcharge problem in small dendritic networks. The theory of storm sewer hydraulics is briefly reviewed. The application of the theoretical equations to the surcharge problem, through the use of numerical techniques, is described. A computer simulation model of open-channel, surcharge and transitional flows in networks is developed . The model capabilities are demonstrated by two example applications. The simulation results are presented and discussed.
W81-02270

8H. Rapid Excavation

GROUND FREEZING HALTS SEWER COLLAPSE.
American City and County, Vol 95, No 9, p 85, September, 1980.

Descriptors: *Freezing, *Interceptor sewers, *Ice-brine systems, Engineering structures, Calcium chloride, Temperature, Brines, Sewerage, Coolants, Methodology, Excavation, Tunneling, Nitrogen, Maintenance, Groundwater, *Sewer repairs, Detroit, Pipelines.

Refrigerated calcium chloride brine was injected into the ground to stabilize soil and stop groundwater flow during repair of a large interceptor sewer in Detroit. The technique was developed for use in Welsh coal mines in the nineteenth century. Calcium chloride can be replaced by liquid nitrogen to reduce the time required to freeze the soil. The method has little or no long term effect on soil or the water table. The freeze used to repair the sewer in Detroit consumed 500 tons of liquid nitrogen and required 54 days. This method has very high costs and may be unsuitable for some groundwater regimes.
W81-02220

8I. Fisheries Engineering

SEWAGE SLUDGE AND CARROT WASTES AS SUPPLEMENTARY FEED FOR THE COMMON CARP CYPRINUS CARPIO,
Hong Kong Univ. Dept. of Biology.
For primary bibliographic entry see Field 3C.
W81-02239

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

AN ANNOTATED BIBLIOGRAPHY OF DEVICES DEVELOPED FOR DIRECT MEASUREMENT OF SEEPAGE,
Geological Survey, Denver, CO. Water Resources Div.
M. R. Carr, and T. C. Winter.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $5.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-344, January, 1980. 38 p, 14 Fig.

Descriptors: *Bibliographies, *Instrumentation, *Seepage, *Measurement, Lake beds, Percolation, Surface-groundwater relationships, Groundwater movement, Seepage meters, Hydraulic potential probes, Seepage measurement.

The need for information on the interrelationship of groundwater and surface water is causing a growing interest in methods used for direct measurement of seepage to and from surface-water bodies. Instruments developed for measurement of seepage date from about the mid 1940's largely in response to the need for knowing the quantity of seepage loss from canals. This bibliography includes abstracts, summaries, or conclusions from papers describing seepage measurement devices. Illustrations of the instruments are included. (USGS)
W81-02370

10D. Specialized Information Center Services

IDENTIFICATION CODES FOR ORGANIZATIONS LISTED IN COMPUTERIZED DATA SYSTEMS OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards, and B. M. Myers.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $12.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-555 (supersedes Open-File Report 79-331), 1980. 94 p, 1 Fig, 2 Ref.

Descriptors: *Data storage and retrieval, *Information exchange, *Organizations, Indexing, Data transmission, *Organization identification code, Computerized data systems, *U.S. Geological Survey, National Water Data Exchange (NAWDEX).

This report contains codes for the identification of public and private organizations listed in computerized data systems. These codes are used by the U.S. Geological Survey's National Water Data Exchange (NAWDEX), National Water Data Storage and Retrieval System (WATSTORE), National Cartographic Information Center (NCIC), and Office of Water Data Coordination (OWDC). The format structure of the codes is discussed and instructions are given for requesting new codes. (USGS)
W81-02344

DIRECTORY OF MEMBER ORGANIZATIONS OF THE NATIONAL WATER DATA EXCHANGE (NAWDEX),
Geological Survey, Reston, VA. Water Resources Div.
J. M. Nokes, and C. D. Blackwell.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $7.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-556 (supersedes Open-File Report 79-1075), 1980. 54 p, Append.

Descriptors: *Data storage and retrieval, *Water resources, *Hydrologic data, *National Water Data Exchange(NAWDEX), *Directories, Member organizations.

The National Water Data Exchange (NAWDEX) is a national confederation of water-oriented organizations working together to improve access to water data. It consists of member organizations from all sectors of the water-data community. This Directory provides the names, addresses, and telephone numbers of all NAWDEX member organizations and their designated NAWDEX representatives. (USGS)
W81-02389

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- WATER QUALITY MANAGEMENT AND PROTECTION
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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 14, NUMBER 13
JULY 1, 1981

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

VOLUME 14, NUMBER 13
JULY 1, 1981

W81-02401 -- W81-02650

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

THERMAL SPRINGS IN THE PAYETTE RIVER BASIN, WEST-CENTRAL IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
R. E. Lewis, and H. W. Young.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $6.00 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 80-1020 (WRI), October, 1980. 23 p, 4 Fig, 4 Tab, 18 Ref, 2 Plates.

Descriptors: *Geothermal studies, *Thermal springs, *Chemical analysis, *Idaho, Hydrogeology, Water temperature, Stable isotopes, Radioisotopes, Discharge(Water), Heat balance, *Payette River basin(ID), Idaho batholith.

The Payette River basin, characterized by steep, rugged mountains and narrow river valleys, occupies an area of about 3,300 square miles in west-central Idaho. Predominant rock types in the basin include granitic rocks of the Idaho batholith and basalt flows of the Columbia River Basalt Group. Waters from thermal springs in the basin, temperatures of which range from 34 to 86 degrees Celsius, are sodium bicarbonate types and are slightly alkaline. Dissolved-solids concentrations range from 173 to 470 milligrams per liter. Reservoir temperatures determined from the sodium-potassium-calcium and silicic acid-corrected silica geothermometers range from 53 to 143 degrees Celsius. Tritium, present in concentrations between 0 and 2 tritium units, indicate sampled thermal waters are at least 100 years old and possibly more than 1,000 years old. Stable isotope data indicate it is unlikely any of the nonthermal waters sampled are representative of precipitation that recharges the thermal springs in the basin. Thermal springs discharged about 5,700 acre-feet of water in 1979. Associated convective heat flux is 1.1x10 to the 7th power calories per second. (USGS)
W81-02472

2. WATER CYCLE

2A. General

SNOWMELT INFILTRATION AND RUNOFF ON FROZEN GROUND,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. L. Kane.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185274, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, No 80-06, February, 1981. 23 p, 10 Fig, 1 Tab, 7 Ref. OWRT-A-068-ALAS(1).

Descriptors: *Snowmelt, Surface runoff, *Soil moisture, *Frozen ground, *Infiltration, *Runoff forecasting, Rainfall-runoff relationships, Melting, Overland flow, Runoff, Soilwater movement, Ablation, Snowfall, Surface drainage, Water sources, Water supply, Analytical techniques, Frozen soils, Thawing, Leachate, Research and development.

Many cold region floods have resulted by snow ablation. Accurate flood magnitude predictions using computer models hinge on an understanding of the hydrologic role of frozen soils. Moisture content was examined to determine how its profile in soils changes over the Winter season, and how such moisture redistribution influences snowmelt infiltration in the Spring. Soil moisture generally migrated towards the freezing front from warmer soils, resulting in moisture content increase near the mineral soil surface. With high ice contents, the infiltration rate (IR) is reduced and greater runoff is produced. The variation in IR of Fairbanks silt loom for frozen and unfrozen conditions was studied using double ring infiltrometer test methods. Typical IR values for unfrozen soil range from .003-.010 mm/second. Dry frozen soil IR rates were usually slightly less than the unfrozen case, due to ice lenses that developed near the surface. For moisture-rich soil, a substantial reduction in IR was noted, with values as low as .0000002 mm/second. Low IR rate areas would be suspected as runoff generating areas. (Zielinski-IPA)
W81-02421

2B. Precipitation

THE HIPLEX PROGRAM IN COLBY-GOODLAND, KANSAS: 1976-1980,
Environmental Research and Technology, Inc., Concord, MA.
R. K. Crane, and K. R. Hardy.
Document P-1552-F, prepared for Water and Power Resources Service, Denver, Colorado, January, 1981. 152 p, 44 Fig, 11 Tab, 38 Ref, 2 Append. 14-06-D-7673.

Descriptors: *Radar, *Cloud physics, *Meteorological data collection, *Precipitation, *Weather modification, Cloud seeding, Rainstorms, Rain gages, Computer programs, Kansas, Nebraska, Colorado.

The primary goal of HIPLEX is to develop and evaluate the use of seeding techniques for the enhancement of precipitation in the high plains area. Accurate and reliable methods are required for the observation of the water mass produced by a storm and for the estimation of the water mass a seeded storm would have produced if it were not seeded. As a part of HIPLEX, a major field program was conducted in the Colby-Goodland area of Kansas over a period of 5 years. A radar based precipitation measurement capability was established in the tri-state area within 150 km of Goodland, Kansas. Automated radar cell detection and tracking programs were developed for the CYBER 74. The storm elements in the radar analysis sample exhibited a high degree of internal organization, with the cells of the storm elements occurring in clusters. The precipitation parameter defined as the water flux per significant cell, and cluster displayed the most consistent storm to storm behavior. An estimate of the modification potential of the Kansas storms led to an expected increase in rainfall of less than 4%. If seeding operations are constrained to days with no local warnings and are successful only for isolated storms, the expected increase in precipitation is less than one percent. (Moore-SRC)
W81-02501

2C. Snow, Ice, and Frost

SATELLITE OBSERVATION OF GREAT LAKES ICE - WINTER 1978-79,
National Environmental Satellite Service, Washington, DC.
J. Wartha-Clark.
Technical Memorandum NESS 112, October, 1980. 39 p, 26 Fig, 1 Ref.

Descriptors: *Lakes, *Lake ice, *Ice formation, *Ice cover, Wind, Air temperature, Satellite technology, Remote sensing.

Ice conditions on the five Great Lakes and Lake St. Clair were monitored from satellite imagery from TIROS-N and the Geostationary Operational Environmental Satellite (GOES). The formation, movement, and dissipation of lake ice were traced from December 1978 through May 1979. Local climatological data were observed at 16 ground stations. Maximum extent of ice occurred simultaneously on all of the Great Lakes on February 17. The ice season on Lake Superior began near December 28 and lasted until May 12, a full 135 days with maximum extent of 100% ice coverage occurring on February 17. The ice season on Lake Michigan began on December 9 and ended near April 27, a total of at least 140 days. Ice began forming in Lake Huron on December 10 and lasted until April 28, a total of 139 days with maximum extent of 95% concentration. The ice season on Lake St. Clair commenced December 15 and ended on March 27, with 100% coverage from January 11 through March 11. The ice season on Lake Erie lasted from December 15 until April 29, a total of 136 days, with maximum extent of ice occurring on February 27 with a greater than 95% concentration. For Lake Ontario, the ice season commenced on January 9 and ended on March 27, a total of 78 days, with maximum ice extent of 80% coverage. Air temperatures at the stations surrounding the lakes are correlated with ice formation and degeneration; ice movement is a function of wind speed and direction. (Moore-SRC)
W81-02507

2E. Streamflow and Runoff

FLOODS OF JANUARY AND FEBRUARY 1980 IN CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
K. L. Wahl, J. R. Crippen, and J. M. Knott.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $7.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1005, August, 1980. 52 p, 16 Fig, 6 Tab.

Descriptors: *Floods, *Flood flow, *Peak discharge, Storm runoff, *California, Flood damage, *Flood data, Sediment discharge, Flood stages, Flood discharge, Precipitation(Atmospheric), Southern California.

During January and February 1980, storms caused substantial rises in streamflow throughout much of California. In mid-January flooding occurred in the foothills of the Sierra Nevada and in the central coast area. In late January and mid-February, high floodflows in streams in coastal southern California caused much damage and several deaths. The Tijuana River in northern Baja California and southern San Diego County flooded many square miles of lowlands as its flow during two separate flooding episodes exceeded all records. Most reservoirs in San Diego County spilled, several for the first time since their completion. Lake Elsinore, in eastern Riverside County, caused damage to lakeside property as it filled to an elevation not reached since 1916. February flooding in southern California was caused by a series of storms separated by short intervals. Some peaks of record were observed, and streamflow throughout the area remained high for a relatively long period. In many streams, the volume of sustained flow for periods of 7 and 15 consecutive days were the greatest that have occurred during the period of record. (USGS)
W81-02457

FLOODS IN INDIANA, JUNE-AUGUST 1979,
Geological Survey, Indianapolis, IN. Water Resources Div.
R. L. Gold, and S. W. Wolcott.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $8.75 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-1204, November, 1980. 64 p, 24 Fig, 6 Tab, 5 Ref.

Descriptors: *Floods, *Indiana, *Peak discharge, *Streamflow, *Flood damage, Flood recurrence interval, Storms, Hydrologic data, Flood stages, Observation wells, Sites, Hydrographs, Hurricane Bob, Hurricane Claudette.

This report documents rainstorms and resultant floods in central and southern Indiana during the summer of 1979. Major flooding was caused by three storms, one in June and two in July 1979, centered primarily in central and southern Indiana. Peak discharge exceeded the 100-year recurrence interval at 16 sites in this area. State Civil Defense officials estimated that almost 50-million dollars damage was attributable to the July floods. Hydrologic data have been tabulated for streamflow sites in the areas of flooding. Reservoir storage volumes, observation-well data, rainfall totals, and discharge hydrographs are presented to show the intensity and time of the storms and resultant floods. (USGS)
W81-02471

STREAMFLOW MODEL OF WISCONSIN RIVER FOR ESTIMATING FLOOD FREQUENCY AND VOLUME,
Geological Survey, Madison, WI. Water Resources Div.
W. R. Krug, and L. B. House.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $7.50 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 80-1103 (WRI), November, 1980. 44 p, 14 Fig, 5 Tab, 3 Ref, 2 Append, 1 Plate.

Descriptors: *Computer models, *Streamflow, Routing, *Flood frequency, *Flood discharge, Simulation analysis, Reservoirs, Reservoir operation, Regulated flow, Natural flow, Streamflow forecasting, Flood recurrence interval, Annual peak discharge, Model studies, Hydrographs, *Wisconsin, *Wisconsin River.

A set of daily streamflow-routing models are used to simulate streamflow at 10 sites along the Wisconsin River for water years 1915-76, to determine the effects the reservoir system has on flood discharges. Streamflow is simulated under the following two conditions: (1) No reservoirs are in the system and (2) all of the present reservoirs are in place and operated with current rules. At Wisconsin Dells, 20 miles upstream from Portage, daily streamflow hydrographs are estimated for the 10-, 50-, 100-, and 500-year floods. These were determined from statistical analysis of the simulated daily streamflows for the condition of all reservoirs in place. The reservoirs have a significant impact on floods. The mean annual flood peak at Wisconsin Dells is lowered about 20% from 43,000 cubic feet per second for the simulated, unregulated condition to 34,000 cubic feet per second for the simulated, regulated condition. The 100-year flood peak at Wisconsin Dells is reduced about 10% (92,000 to 82,000 cubic feet per second) between the simulated, unregulated and simulated, regulated conditions. The 100-year flood peak at Wisconsin Dells, computed from the simulated, regulated streamflow data for the period 1915-76, is 82,000 cubic feet per second, including the effects of all the reservoirs in the river system, as they are currently operated. It also includes the effects of Lakes Du Bay, Petenwell, and Castle Rock which are significant for spring floods but are insignificant for summer or fall floods because they are normally maintained nearly full in the summer and fall and have very little storage for floodwaters. (USGS)
W81-02474

SUMMARY OF STREAMFLOW IN JEFFERSON COUNTY, ALABAMA,
Geological Survey of Alabama, University. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02476

LOW-FLOW FREQUENCY AND FLOW DURATION OF SOUTH CAROLINA STREAMS,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02484

GEOMORPHIC-HYDROLOGIC METHODS FOR ASSESSING FLOOD POTENTIAL IN SOUTHERN NEW ENGLAND,
Wesleyan Univ., Middletown, CT.
P. C. Patton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-189862, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Resources, The University of Connecticut, Storrs Research Project Technical Completion Report, 1981. 25 p, 10 Fig, 13 Ref. OWRT A-078-CONN(2), 14-34-0001-7014.

Descriptors: Floods, Flood plain sedimentation, *Flood forecasting, *New England, Paleohydrology, Holocene fluvial stratigraphy, *Flood plains, *Sediment transport, Flood frequency, Geomorphology.

The morphology and stratigraphy of Holocene fluvial landforms in southwestern New England can be used to estimate the magnitude and frequency of rare floods. Three geomorphic features, debris fans, Holocene terrace and active flood plains were investigated to determine their usefulness for paleohydrologic studies. Dated flood sedimentation units on debris fans indicate that deposition on these features is controlled by relatively high frequency flow events of moderate size. Therefore, debris fans are probably not useful geomorphic features for paleohydrologic studies. Flood sedimentation units preserved on Holocene terraces and flood plains on western Connecticut streams can be used to interpret past flood events. Sedimentation on these surfaces is strongly controlled by valley morphology. In the mouths of back flooded tributaries and upstream from valley constrictions ponded water creates slackwater depositional sites. A slackwater site in the Housatonic River valley interbedded with archeological remains records a flood that occurred in the past 3,000 years. This flood was probably greater than the existing historical flood of record. Downstream from valley constrictions flood sedimentation creates coarse gravel layers across the flood plains and low terraces. These layers are preserved in vertical sequences that record the frequency of high magnitude floods. Finally, the flood sedimentation models developed are useful in predicting sedimentation patterns on river flood plains and terraces. This information has been used in western Connecticut to aid in the evaluation of potentially valuable archeological sites.
W81-02495

BIVARIATE GAMMA DISTRIBUTIONS FOR EXTENDING ANNUAL STREAMFLOW RECORDS FROM PRECIPITATION: SOME LARGE-SCALE RESULTS,
Instituto de Pesquisas Hidraulicas, Porto Alegre (Brazil).
R. T. Clarke.
Water Resources Research, Vol 16, No 5, p 863-870, October, 1980. 5 Tab, 6 Ref.

Descriptors: *Streamflow forecasting, *Estimating, *Mathematical models, Forecasting, Flow, River forecasting, Precipitation, Hydrology, Model studies.

Streamflow records may be extended by correlation with longer records of precipitation to estimate the mean of the extended streamflow record. Assuming a bivariate gamma distribution for streamflow and precipitation and a sufficiently long record, estimates are obtained and compared using three methods: maximum likelihood, ratio estimate, and regression estimate. This model is recommended for hydrological use only after certain questions have been answered: How can a user determine if his data are bivariate. What differences would result if bivariate distribution were to be used in place of a more appropriate alternative. (Cassar-FRC)
W81-02585

2F. Groundwater

DEVELOPMENT OF A DIGITAL MODEL OF GROUNDWATER FLOW IN DEEPLY WEATHERED CRYSTALLINE ROCK, CHESTER COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
L. J. McGreevy, and R. A. Sloto.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-132896, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-2, August, 1980. 42 p, 22 Fig, 1 Tab, 13 Ref.

Descriptors: *Computer models, Groundwater, *Base flow, *Crystalline rocks, *Pennsylvania, Model studies, Aquifer characteristics, Water table, *Groundwater movement, Recharge, Surface-groundwater relationships, Water quality, Land development, Forecasting, Hydrogeology, Chester County(PA), Pickering Creek(PA), Piedmont.

The model simulates recharge to, flow through, and discharge from the water-table aquifer in a 5.98 square mile basin representative of most of Chester County, Pa. The two-dimensional finite-difference model of Trescott, Pinder, and Larson was used. The way groundwater evapotranspiration varies with depth was modified, and a minimum transmissivity was added to prevent the model from 'going dry'. Tests of the model showed good correlation with field data, but also showed that additional information would make the model more reliable. Particularly helpful would be more water-level and evapotranspiration data, synoptic base-flow measurements, and information the variation of permeability and specific yield with depth. Residential development was simulated in 1 square mile of the basin using combinations of the following conditions: 1 acre, 1/2 acre, and 1/4 acre lot size; waste water disposal by septic systems or by public sewering; domestic wells or public-supply wells for water supply; and 0, 1, and 5% reduction in recharge in the developed area. Where domestic water is supplied by local groundwater, decreased lot size and reduced recharge cause increased drawdowns and reduced base flow. When waste water is exported by sewers, these effects are magnified. (USGS)
W81-02446

MAJOR AQUIFERS IN AURORA AND JERAULD COUNTIES, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
L. J. Hamilton.
South Dakota Geological Survey, Vermillion, Information Pamphlet No 23, 1980. 5 p, 2 Fig.

Descriptors: *Groundwater, *Aquifers, *Water wells, *Water yield, *South Dakota, Aquifer characteristics, Hardness(Water), Dissolved solids, Aurora County(SD), Jerauld County(SD).

Five major glacial aquifers and three major bedrock aquifers underlie much of the 1,236 square miles of Aurora and Jerauld Counties, south-central South Dakota. The glacial aquifers generally are penetrated within 200 feet of the land surface and the bedrock aquifers from 100 feet to a maximum of 1,300 feet in the northwestern part of the study area. The glacial aquifers can yield as much as 1,000 gallons per minute to a well. Well yields for bedrock aquifers vary greatly. Yields for the Niobrara and Codell aquifers generally range between 2 and 75 gallons per minute, but a densely-fractured part of the Niobrara has yielded 1,500 gallons per minute. Reported yields for the Dakota aquifer are as large as 150 gallons per minute. The water yielded by glacial aquifers generally is very hard (hardness concentrations greater than 180 milligrams per liter) and has concentrations of dissolved solids ranging from 700 to 3,300 milligrams per liter. The Niobrara and Codell aquifers yield soft to moderately hard water (hardness concentrations less than 120 milligrams per liter) and the Dakota aquifer yields very hard water that has a maximum hardness of 1,400 milligrams per liter. The concentration of dissolved solids ranges from 1,100 to 2,400 milligrams per liter for water from bedrock aquifers. (USGS)
W81-02449

HYDROLOGY AND CHEMICAL QUALITY OF GROUNDWATER IN CROWLEY COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02451

ALTITUDE OF THE WATER TABLE IN THE ALLUVIAL AND WILCOX AQUIFERS IN THE VICINITY OF RICHLAND AND TEHUACANA CREEKS AND THE TRINITY RIVER, TEXAS, DECEMBER 1979,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02453

GROUNDWATER APPRAISAL IN NORTHWESTERN BIG STONE COUNTY, WEST-CENTRAL MINNESOTA,

Geological Survey, St. Paul, MN. Water Resources Div.
W. G. Soukup.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $5.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-568 (WRI), 1980. 41 p, 18 Fig, 2 Tab, 19 Ref.

Descriptors: *Groundwater resources, *Aquifers, *Aquifer characteristics, *Water quality, *Minnesota, Hydrogeology, Observation wells, Pumping, Transmissivity, Storage coefficient, Lithologic logs, Chemical analysis, Water resources development, *Big Stone County(MN).

Test augering south of Beardsley, Big Stone County, Minn., outlined a small surficial aquifer that consists of outwash deposits of sand and gravel. The aquifer is elongate, trending northeast-southwest, with a maximum saturated thickness of 42 feet and an areal extent of about 5 square miles. Deep test drilling showed that small buried outwash aquifers occur over much of the project area. A major buried outwash aquifer east of Beardsley consists of 130 feet of fine, uniform quartz sand. It lies in a steep-sided northwest-southeast trending valley eroded in bedrock and is overlain by 130 feet of clayey till. Pumping-test results indicate that transmissivity of the aquifer ranges from about 11,000 to 13,000 feet squared per day, and the storage coefficient ranges from 0.0001 to 0.002. Significant differences were found in chemical quality of water from the buried outwash and Cretaceous aquifers. Water from Cretaceous aquifers is softer than water from outwash aquifers, but contains concentrations of sodium and boron that are high enough to damage soils and crops if used for irrigation. Nitrate concentrations exceeded the Minnesota Pollution Control Agency's recommended limits for drinking water in one sample from the surficial aquifer. (USGS)
W81-02454

WATER-LEVEL CONTOUR AND SALT-FRONT MAP, HIALEAH-MIAMI SPRINGS WELL FIELD AREA, DADE COUNTY, FLORIDA, OCTOBER 13, 1978,
Geological Survey, Miami, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02461

MAPS SHOWING GROUNDWATER CONDITIONS IN THE UPPER SAN PEDRO BASIN AREA, PIMA, SANTA CRUZ, AND COCHISE COUNTIES, ARIZONA--1978,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02462

GROUNDWATER AVAILABILITY NEAR FORT WAYNE, ALLEN COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
M. Planert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-226038, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-34, March, 1980. 54 p, 25 Fig, 4 Tab, 9 Ref.

Descriptors: *Groundwater availability, *Groundwater resources, *Groundwater potential, *Glacial aquifers, *Indiana, Aquifer characteristics, Model studies, Data collections, Groundwater movement, Pumping, Water level fluctuations, Water supply, Evaluation, *Allen County(IN).

A 3-year study to determine the groundwater potential of confined glacial aquifers in a large part of Allen County, Ind., was begun in July 1974 by the U.S. Geological Survey. Mapping of outwash sands and gravels delineated two distinct layers of sand and gravel in the southern and eastern parts of the county that merge into one aquifer more than 100 feet thick to the north and west. A digital model that simulates groundwater flow in three dimensions was used to integrate the geologic and hydrologic conditions into a suitable analog of the groundwater system surrounding Fort Wayne. The model consisted of three layers representing (1) the upper till, (2) the upper sand and gravel, and (3) the lower aquifer. The lower aquifer represents a combination of the lower sand and gravel and a section of limestone aquifer immediately underlying the glacial sediments. The model, calibrated against water-level and streamflow data collected during September 1976, was used to simulate pumping and to evaluate the effects of pumping on groundwater levels and streamflows. Two distribution schemes of pumping were tested, each with two different boundary conditions (constant heads and constant flows). The results of these simulated pumping schemes indicate that between 30 and 40 million gallons per day can be produced and that the streamflow losses resulting from this pumping would be between 17 and 25 million gallons per day. (USGS)
W81-02466

SUMMARY APPRAISALS OF THE NATION'S GROUNDWATER RESOURCES--CARIBBEAN REGION,
Geological Survey, San Juan, PR. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-02473

THREE-DIMENSIONAL DIGITAL-COMPUTER MODEL OF THE FERRON SANDSTONE AQUIFER NEAR EMERY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
D. J. Morrissey, G. C. Lines, and S. D. Bartholoma.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-128449, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-62, October, 1980. 101 p, 8 Fig, 3 Tab, 3 Ref.

Descriptors: *Computer models, *Groundwater movement, *Saturated flow, *Finite element analysis, *Utah, Simulation analysis, Forecasting, Mine water, Dewatering, Aquifer characteristics, Water levels, Transmissivity, Storage coefficient, Calibrations, Methodology, Emery(UT), Ferron sandstone aquifer(UT).

A three-dimensional finite-difference computer model of the Ferron sandstone aquifer was used to simulate groundwater flow in the Emery coal field in east-central Utah. The model also was used to predict the effects of proposed surface mining and the resulting mine dewatering on potentiometric surfaces of the aquifer. The model was calibrated in a steady-state simulation using water levels and manmade discharges from the aquifer that were observed during 1979. Too few data were available to verify the calibrated model in a transient-state simulation with historical aquifer response to manmade discharges. Predictions made with the model are considered to be semiquantitative. Discharge from the proposed surface mine was predicted to average 0.3 cubic foot per second through 15 years of operation. Drawdowns of 5 feet in the potentiometric surface of the aquifer were predicted to extend as much as 3 miles from the proposed mine after 15 years of operation. (USGS)
W81-02481

2H. Lakes

HYDROLOGY OF THE LAKE DEATON AND LAKE OKAHUMPKA AREA, NORTHEAST SUMTER COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
E. P. Simonds, and E. R. German.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-733, 1980. 11 Fig, 3 Tab, 10 Ref, 1 Sheet.

Descriptors: *Lakes, *Lake morphology, *Hydrologic data, *Aquifers, *Florida, Evaporation, Rainfall, Water levels, Potentiometric level, Eutrophication, Phytoplankton, Water quality, Water analysis, Nutrients, *Sumter County(FL), *Lake Deaton(FL), *Lake Okahumpka(FL), Surface-groundwater relations.

The Floridan aquifer in the Lake Deaton and Lake Okahumpka area is 50 to 130 feet below land surface. During the 16-year period 1963-78 lake evaporation exceeded rainfall by 0.4 inches. Drainage from Lake Deaton and its surrounding area goes into Chitty Chatty Creek and on the Hogeye Sink when the altitude of the potentiometric surface of the Floridan aquifer is low. During a higher altitude of the Floridan potentiometric surface, Hogeye Sink may discharge water; this water, along with the normal runoff, goes into Lake Okahumpka. Average lake fluctuation is 1.5 to 2.0 feet per year. Lake Deaton supports a large population of blue-green algae and Lake Okahumpka is choked with aquatic plants. The water quality of the two lakes differ, with Lake Deaton having a sodium chloride water and Lake Okahumpka having a calcium bicarbonate water. Analysis of water and bottom material samples showed that only cadmium and mercury exceeded the Florida Department of Environmental Regulation's criteria for Class III waters; however, the amounts detected were at or slightly above the limits of the analytical method. (USGS)
W81-02452

A SIMPLE IN SITU METHOD FOR MEASURING BENTHIC RESPIRATION,
Ministry of Agriculture, Tiberias (Israel). Unit for Applied Research in Intensive Fish Culture.
J. Shapiro, and O. Zur.
Water Research, Vol 15, No 2, p 283-285, February, 1981. 2 Fig, 1 Tab, 6 Ref.

Descriptors: *Respiration, *Benthos, *On-site tests, Aquiculture, Dissolved oxygen, Toxins, Water quality, Sediments, Mud-water interfaces, Water pollution, Analytical techniques, *Fish stocking, Aquatic populations, Number fish per acre, Anaerobic conditions.

It has been shown in fish culturing that anaerobic conditions at the bottom of ponds due to accumulation of organic matter may result in the production of toxins that are inhibitory to fish growth. It is therefore of benefit to have a knowledge of the physical and chemical conditions of the bottom sediments, including data on benthic community respiration. A simple and accurate procedure for the in situ measurement of benthic community respiration involving determinations of bottom mud dissolved oxygen (DO) is reported. PVC columns 100 cm long and 5.65 cm in diameter were inserted into pond bottom muds to a depth of 10 cm, and DO levels were measured at sunrise and in the afternoon at 20, 40, 60, and 80 cm of the columns. During the 47 day experimental period, the rate of pond soil respiration increased from 0 to 130 and 0 to 220 in the ponds stocked with 7,000 and 20,000 fish per hectare, respectively. Results also indicated that changes in soil respiration may be related to variations in stocking and feeding rates in the pond. (Geiger-FRC)
W81-02573

BENTHIC OXYGEN DEMAND IN LAKE APOPKA, FLORIDA,
Florida Inst. of Tech., Melbourne. Dept. of Environmental Engineering and Science.
T. V. Belanger.
Water Research, Vol 15, No 2, p 267-274, February, 1981. 6 Fig, 3 Tab, 20 Ref.

Descriptors: *Oxygen demand, *Lake sediments, *Benthos, Eutrophication, Biochemical oxygen demand, Respiration, Lakes, *Florida, Analytical techniques, On-site tests, Laboratory tests, Nitrogen, Aquatic bacteria, Mixing, Water analysis, Flow rates, Lake Apopka.

Rates of oxygen uptake by the sediments of Lake Apopka, Florida, were measured to clarify the role of the benthic oxygen demand in the oxygen dynamics of this system. Laboratory core uptake and flow-through system techniques were used for the

determinations of oxygen demand at 5 sampling stations on the lake. Partitioning experiments showed that the oxygen uptake was mainly biological, and the majority of this was due to bacterial respiration. Core uptake for the 5 sampling sites averaged 67 milligrams 02/sq meter/hour, with no significant correlations with levels of total Kjeldahl nitrogen, percent volatile solids, or macroinvertebrate densities. A logarithmic relationship between the sediment oxygen uptake rates and the flow rate is described. At high flow rates (over 200 liters/hour), the flow-through system sediment oxygen uptake at each station approached similar maximum uptake rates of 130 milligrams 02/sq meter/hour. During periods of intense wind mixing, the sediment uptake rates are expected to approximate these values due to the extreme shallowness of the lake. The relatively low sediment oxygen uptake rates obtained for Lake Apopka support the hypothesis that sediment respiration is progressively replaced by respiration in the water column during eutrophication. (Geiger-FRC)
W81-02575

ENRICHMENT OF LAKE WINGRA, WISCONSIN, BY SUBMERSED MACROPHYTE DECAY,
Wisconsin Univ., Madison. Dept. of Botany.
S. R. Carpenter.
Ecology, Vol 61, No 5, p 1145-1155, October, 1980. 10 Fig, 4 Tab, 44 Ref.

Descriptors: *Lakes, *Nutrients, *Dissolved oxygen, Phosphorus, Oxygen, *Wisconsin, Eutrophication, Lake Wingra, Decomposing organic matter, Growth, Population.

Enrichment in Lake Wingra was investigated. This enrichment arises due to the decomposition of submersed aquatic vegetation. A model was constructed to predict the release on a daily basis of dissolved total phosphorus and dissolved organic matter. Fairly accurate predictions of decay rates and the phosphorus content of decaying shoots were attained. During the summer and autumn the decaying macrophytes are a major source of biologically available dissolved total phosphorus and decomposable dissolved organic matter for the pelagic community. Thus macrophyte decay potentially stimulated pelagic production. Among comparably productive stands of different species decomposing in the same lake, significant differences were noted in the timing of dissolved total phosphorus and dissolved organic matter releases. (Baker-FRC)
W81-02602

2I. Water In Plants

PROTEIN AND NITRATE CONTENT OF LEMNA SP. AS A FUNCTION OF DEVELOPMENTAL STAGE AND INCUBATION TEMPERATURE,
California Univ., Davis. Dept. of Land, Air and Water Resources.
A. W. Knight, W. K. Silk, and P. W. Lehman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-189888, Price codes: A02 in paper copy, A01 in microfiche. California Water Resources Center, University of California, Davis Technical Completion Report, March, 1981. 19 p, 10 Fig, 2 Tab. (California Water Resources Center Project UCAL-WRC-W-542). OWRT-A-068-CAL(1).

Descriptors: *Irrigation, *Return flow, *Plant populations, Proteins, Nitrates, Roots, *Root systems, Growth stages, Plant growth, Temperature, Aquatic populations, Successions, *Nutrient removal, Duckweed.

Lemna protein per frond and per root increases with developmental stage until plants are at least two generations old. Protein per frond, per root, and per unit dry weight is greater in plants grown at 23.9C than at 18.3C. More protein is found in fronds than in roots, and more nitrate occurs in roots than in fronds. Nitrate per root increases with developmental stage and is higher (per root) in plants grown at 23.9C than at 18.3C. This distribution of generations within a growing population is constant for at least eight doubling times. Whether populations multiply slowly at 15.6C or more rapidly at 23.9C, fronds which have not yet produced progeny form 62% of the population fronds which are one generation old form 24% of the population; and fronds which are two generations old form 9% of the population. (Snyder-California)
W81-02497

2J. Erosion and Sedimentation

SEDIMENT AND WATER DISCHARGE OF THE COLORADO RIVER AT MATAGORDA, TEXAS, MAY 4-7, AND JUNE 7-11, 1979,
Geological Survey, Austin, TX. Water Resources Div.
C. T. Welborn, and F. L. Andrews.
Geological Survey Open-File Report 80-1177, October, 1980. 21 p, 5 Fig, 2 Tab, 4 Ref.

Descriptors: Sediment load, *Sediment yield, Sediment transport, *Colorado River, *Texas, *Streamflow, Data collections, Suspended load, *Sediment discharge, Particle size, Bed load, Sediment distribution, Sedimentation rates, *Matagorda Bay.

The U.S. Army Corps of Engineers requested the U.S. Geological Survey to collect data on the Colorado River at Matagorda, Texas, to determine the total sediment discharge into Matagorda Bay if all the water from the Colorado River were diverted into the bay. Data were collected from two floods (May 4-7, and June 7-11, 1979) with peak discharges of 24,900 cubic feet per second and 40,900 cubic feet per second. The total suspended-sediment discharge from the first flood was approximately 201,000 tons, and the total suspended-sediment discharge from the second flood was 630,000 tons. The volume of sediment from these two floods was approximately 970 acre-feet with approximately 20 acre-feet of this total being the bed load. (USGS)
W81-02459

WATER USE, GROUNDWATER CONDITIONS, AND SLOPE FAILURE ON BENCHLANDS IN WESTERN MONTANA: THE DARBY SLIDE EXAMPLE,
Montana Univ., Missoula.
J. D. Hoffman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-189854, Price codes: A04 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Montana State University, Bozeman Report No 109, Bozeman, 1980. 56 p, 12 Fig, 32 Ref, 4 Append. OWRT A-114-MONT(1), 14-34-0001-9028.

Descriptors: *Geologic formations, Groundwater recharge, *Seepage, Failure, Hydrogeology, Geologic investigations, Lithologic logs, *Slope degradation, *Montana, *Landslides, Water use, Erosion, Western Montana, Darby slide, Slope failure.

Slope failures, a problem on benchlands of western Montana, affect all who live on the land. A better understanding of lithology and groundwater, both associated with this problem, will help land planners assess risks. The Darby slide provided an opportunity to study the geologic and hydrogeologic conditions existing at the time of failure, and to compare these conditions with those conditions existing now at past failures on the bench west of Darby. Two conditions were similar at the larger of the slope failures of the area: groundwater seeps occurring within areas of failure; and the presence of smectite rich sand similar to exposures of weathered bedrock. A plot of identified groundwater seeps and slope failures shows a concentration along linear features mapped on high altitude aerial photographs. The linears may represent weathered ridges of granitic and volcanic rocks that have been buried by Tertiary gravels and sands. These ridges could act as aquacludes, causing groundwater levels to build up within the porous gravels. Landslides such as the Darby slide can then be explained as a failure of the underground 'dam' when the mass of the gravel and water 'reservoir' becomes too great. Groundwater of many western Montana benches is recharged not only by precipitation and runoff, but also by agricultural and domestic practices. A better knowledge of these linear features would thus be invaluable to land planners.
W81-02494

GEOMORPHIC-HYDROLOGIC METHODS FOR ASSESSING FLOOD POTENTIAL IN SOUTHERN NEW ENGLAND,
Wesleyan Univ., Middletown, CT.
For primary bibliographic entry see Field 2E.
W81-02495

SUSPENDED SEDIMENT PRODUCTION POTENTIAL ON UNDISTURBED FOREST LAND,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Economics and Agricultural Business.
J. M. Fowler, and E. O. Heady.
Journal of Soil and Water Conservation, Vol 36, No 1, p 47-50, January/February, 1981. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Forests, *Sediments, *Surface runoff, Sedimentation rates, Water pollution sources, Agricultural runoff, Sediment load, Model studies, *Suspended sediments, Forest watersheds.

Estimation of suspended sediment production rates on undisturbed forest land is reviewed. The 614 million acres of undisturbed forest land in the US annually contributes more than 100 million tons of suspended sediments to waterways, and rates of this sedimentation can be used for comparisons with rates on silvicultural lands. Some of the basic estimates involved in building a forest model which can be linked with the Iowa State University agricultural model include: parent soil material, drainage area, rainfall, runoff, slope, and elevation. Published research results for watersheds with over 95% of area in undisturbed forest were used. Selected equations and statistics are presented by region. Nonpoint pollution from undisturbed forest land was found to vary widely, ranging from .001 to .009 tons per acre per year in scattered producing areas to as much as 3.3 tons per acre per year on isolated forests in the southern and Pacific Coast areas. When results of sedimentation from forest areas are combined with results from agricultural lands, the Northwest and Southeast were found to have the heaviest suspended sedimentation rates in the contiguous United States. (Small-FRC)
W81-02639

2K. Chemical Processes

THERMAL SPRINGS IN THE PAYETTE RIVER BASIN, WEST-CENTRAL IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 1A.
W81-02472

A COMPILATION OF GROUNDWATER QUALITY DATA FOR KENTUCKY.
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02475

OCCURRENCE AND DISTRIBUTION OF OXYGEN AND ORGANIC COMPOUNDS IN MOUNTAIN STREAMS OF THE MARMOT BASIN,
Calgary Univ. (Alberta). Kananaskis Center for Environmental Research.
S. A. Telang, G. W. Hodgson, and B. L. Baker.
Journal of Environmental Quality, Vol 10, No 1, p 18-22, January/March, 1981. 2 Fig, 2 Tab, 27 Ref.

Descriptors: *Natural streams, *Dissolved oxygen, *Organic compounds, Humic acid, Fulvic acid, Biochemical oxygen demand, Chemical oxygen demand, Water quality, Water analysis, Carbohydrates, Phenols, Amino acids, Seasonal, *Canada, Alberta, Marmot basin.

The occurrence and distribution of organic compounds were examined in relation to oxygen content in the pristine mountain waters of the Marmot basin streams in Alberta, Canada. The levels of dissolved oxygen (DO) in the streams averaged 11,000 micrograms/liter, representing a saturation level of 90-105%. Biochemical oxygen demand was, on the average, 2,000 micrograms/liter, while chemical oxygen demand averaged 4,000 micrograms/liter. The average total organic carbon was 4,000 micrograms/liter, with 25% of this represented by the compounds analyzed. Of this percentage, 2% were labile and 23% refractory organic compounds. The main refractory components, humic and fulvic acids, averaged 790 micrograms/liter, while tannins and lignins averaged 100 micrograms/liter. Of the labile compounds, 0.05 micrograms/liter were hydrocarbons, 2 micrograms/liter were phenols, 2 micrograms/liter were fatty acids, 45 micrograms/liter were carbohydrates, and 10 micrograms/liter were amino acids. The amounts of organic compounds present showed seasonal variations. Since these waters were considered to be virtually untouched by human activities, the source of these organic compounds was concluded to be runoff from terrestrial wildlife and vegetation activities as well as effluents from the vital processes of aquatic flora and fauna. (Geiger-FRC)
W81-02627

2L. Estuaries

COTIDAL CHARTS FOR CANADA,
Marine Sciences and Information Directorate, Ottawa (Ontario).
G. Godin.
Manuscript Report Series No 55, 1980. 93 p, 16 Fig, 6 Tab, 16 Ref.

Descriptors: *Canada, *Tides, *Flow profiles, *Tidal waters, Charts, Hydrographs, Maps, Tidal effects, Water circulation, Foreign countries, Geographical regions, Regions, North America, Bodies of water, Currents(Water), Ocean circulation, Ocean currents, Intertidal areas, Diurnal, Estuaries, Data collections, Synoptic data, Saline water intrusion.

Cotidal charts provide a visual summary of available information about the major harmonic constituents of the vertical tide. Elementary physical theory indicates the tide to be a long wave phenomena having harmonic constituents. The charts may be used to check analysis results of short sets of observations at temporary gauging sites (gross errors in recordings or time-keeping may be picked up by plotting the analyzed values on the appropriate charts). They also assist the designation of areas in which tidal coverage is inadequate and further exploration is needed. A tide of good semidiurnal character requires only one chart (M2) to yield a good estimate, of mean tide amplitude at a given site, and of the mean time of high/low water. A correctly-drawn cotidal chart reveals the structure of the tidal wave of the given frequency in the basin under consideration. Such charts may be used to predict tide in a particular area, and help control the results of numerical modeling of the ocean tide. Mathematical treatment is discussed in 33 equations. The charts show the tidal regime in all ocean waters adjacent to Canada, and the effective response of these waters to tide in the neighboring oceans. (Zielinski-IPA)
W81-02445

NUTRIENT CYCLING IN COASTAL ECOSYSTEMS,
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 5C.
W81-02541

TIDAL RESPONSE IN ESTUARIES,
National Research Council of Canada, Ottawa (Ontario). Hydraulics Lab.
D. Prandle, and M. Rahman.
Journal of Physical Oceanography, Vol 10, No 10, p 1552-1573, October, 1980. 13 Fig, 2 Tab, 14 Ref.

Descriptors: *Tides, *Tidal streams, *Estuaries, Water level fluctuations, Barriers, Friction, Equations, Tidal waters, Rivers, *Tidal hydraulics.

A new general theory of tidal response in estuaries was developed which enables the complete spectral response of an estuary to be determined from just two parameters. These parameters are: an estuarine shape parameter which is dependent on the rate of change of both breadth and depth, and a dimensionless length parameter which is representative of estuarine length. Tidal amplitudes generally increase toward the head of an estuary until the effects of friction, freshwater flow, and nonlinear phenomena predominate, or the progressive truncation of the channel section stops. The gross features of channel geometry seem to determine tidal amplification. The effect of tidal barriers was also examined, with emphasis on the location of a tidal barrier. The maximum change in tidal amplitudes due to barriers rarely exceeds 10%, with increases at nodes and decreases at antinodes. In many estuaries friction was found to play a dominant role in determining tidal amplification. A useful feature of this theory is the fact that for any location, the dimensionless parameter is directly related to tidal frequency. As examples of the application of the theory, tidal responses are examined in the following estuaries: Fraser, Rotterdam Waterway, Hudson, Potomac, Delaware, Miramichi, Bay of Fundy, Thames, Bristol Channel, and St. Lawrence. (Small-FRC)
W81-02631

A STUDY OF TIDAL ENERGY DISSIPATION AND BOTTOM STRESS IN AN ESTUARY,
New Hampshire Univ., Durham. Dept. of Earth Sciences.
W. S. Brown, and R. P. Trask.
Journal of Physical Oceanography, Vol 10, No 11, p 1742-1754, November, 1980. 11 Fig, 2 Tab, 18 Ref.

Descriptors: *Mathematical models, *Estuaries, *Tidal energy, Channels, Tidal hydraulics, Stress, Momentum equation, Energy dissipation, Water pressure, New Hampshire, Great Bay.

A method for determining an area-averaged bottom stress and energy dissipation rate in a tidal estuarine channel was developed. A model of the one-dimensional continuity and momentum relations is presented which uses assumptions appropriate for a well-mixed shallow and narrow estuary. The finite difference form of these relations is derived for a section of the Great Bay estuary in New Hampshire, an estuary with a relatively large energy dissipation rate. Time series of all important first- and second-order terms in the momentum equation are estimated using a set of current, bottom-pressure, and sea-level measurements from Great Bay. The instantaneous first-order balance existed between the surface-slope-induced pressure gradient and bottom-stress forces except for slack water. The inertial and convective acceleration terms yield important second-order contributions to balance. Estimated terms are summed to infer time series of bottom stress. For Great Bay, the 14-day rms bottom stress was 45.1 plus or minus 4.5 dyn per sq cm with a corresponding rms and mean dissipation rate of 3526 plus or minus 420 and 2478 plus or minus 297 ergs per sq cm per sec, respectively. (Small-FRC)
W81-02640

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

NATIONAL SURVEY OF WATER AND WASTE WATER DESALTING PLANT OPERATOR CERTIFICATION PROGRAMS,
National Water Supply Improvement Association, Ipswich, MA.
G. L. Elser.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185308, Price codes: A02 in paper copy, A01 in microfiche. Completion Report for the Office of Water Research and Technology, December 15, 1980. 4 p, 1 Append. OWRT-C-00166-D(No 0468)(1), 14-34-0001-0468.

Descriptors: *Desalination plants, *Desalination, *Water supply, Water purification, Training, *Surveys, Evaluation, Desalination wastes, Industrial plants, Treatment facilities, Separation techniques, Water treatment, Engineering education, Schools(Education), Analysis, Assessments, Waste water treatment, Water reuse, Quality control, Water quality.

A State-by-State survey was conducted in an attempt to determine the extent that State water and waste water treatment operator certification programs incorporate desalting within the other elements of water sciences. All 50 States, the Virgin Islands and Puerto Rico were mailed questionnaires, with 85% (44) responding. Information was obtained by telephone from the remaining eight States. The results of this survey have been summarized. The survey indicated a national lack of awareness in the increasing use of desalting technology for water and waste water treatment. Only five responses (10%) stated that desalting was included in their present certification programs. Three States indicated intent for desalting qualifications inclusion in the immediate future. The remaining States (87%) had neither reference to desalting nor any plans for its addition in the immediate future. There is a definite need to increase awareness of State certification agencies on the growing importance of desalting expertise for operators of water and waste water facilities, due to the increasing development of domestic waste water and industrial desalting plants in the United States. (Zielinski-IPA)
W81-02425

LIGHT-DRIVEN WATER DESALINIZATION THROUGH ARTIFICIAL MEMBRANES CONTAINING BACTERIORHODOPSIN,
California Univ., San Francisco. School of Medicine.
J. I. Korenbrot.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-184152, Price codes: A06 in paper copy, A01 in microfiche. Final Report, (1981). 113 p, 22 Fig, 4 Tab, 116 Ref, 2 Append. OWRT-S-0120(No 8511)(1), 14-34-0001-8511.

Descriptors: *Desalination processes, *Desalination apparatus, *Membrane processes, Membranes, *Proteins, Films, Thin films, Water treatment, Treatment, Separation techniques, Water purification, Water sources, Desalination, Research and development, Biological membranes, Electro-osmosis, Light intensity, Aquatic environment, Light.

This study sought to develop technology to produce membranes that would incorporate the biological protein bacteriorhodopsin, a light-activated proton transporter, for operation as light-driven water desalting systems (by coupling the flux of protons to a counter-flux of cations and anions). Incorporation of the protein was successful, using a new and unorthodox method. Planar membrane films were formed by sequential transfer of two air-water interface films onto a thin hydrophilic electrically-conductive support cast from nitrocellulose. One of the films consisted of non-overlapping single-sheet membrane fragments (purple membrane) containing the protein; the second film consists of a phospholipid monolayer. Planar membranes produced by assembly of the interface films are easily accessible to electrical measurements and control of the ionic milieu on either membrane side. Illumination of these films produces photocurrents/voltages and pH changes in the milieu. Photocurrent amplitude, linearity of increase with light intensity, transport stoichiometry (protons/absorbed photon), and P-31 NMR of phospholipid in the purple membrane were evaluated and reported. (Zielinski-IPA)
W81-02429

3C. Use Of Water Of Impaired Quality

WATER QUALITY CHARACTERISTICS AND PHYSIOLOGICAL RESPONSES OF FISH HELD IN RECIRCULATING SYSTEMS,
Memphis State Univ., TN. Dept. of Biology.
K. B. Davis, and B. A. Simco.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-189870, Price codes: A03 in paper copy, A01 in microfiche. Tennessee Water Resources Research Center, University of Tennessee, Knoxville Research Report No 69, December, 1978. 40 p, 13 Fig, 6 Tab, 42 Ref. OWRT-B-036-TENN(1), 14-34-0001-7188.

Descriptors: Ammonia, Calcium, Catfish, Fish culture, Stress, Toxicity, Urine electrolyte excretion, *Water quality, *Recirculated water, *Fish physiology, Osmoregulation, Plasma electrolytes, Recirculating raceways.

Lethal and sublethal concentrations of ammonia and salinity for channel catfish held in recirculating systems were studied in relation to environmental calcium levels. Environmental calcium had no effect on the renal excretion of water or of any electrolytes except calcium. Plasma and muscle electrolytes from fish acclimated to fresh water or 7.5 g/liter sodium chloride were similar, but electrolyte levels increased dramatically in fish acclimated to 11 g/liter sodium chloride at both 10 and 23C. No influence of environmental calcium was observed when fish were acclimated to sublethal salinities. Addition of calcium reduced mortalities in fish exposed to normally lethal salinities. Lethal concentrations of total ammonia were found to vary dramatically with pH, and to be dependent primarily on the concentration of the un-ionized form. Ammonia toxicity was decreased by increasing environmental calcium of the test water. Ammonia toxicity was reduced for fish in isonatremic water for 24 hours. Since plasma sodium levels of ammonia exposed fish in fresh water tests were lower than controls, an osmoregulatory disturbance is suggested as one mechanism of ammonia toxicity. These results stress the importance of understanding interactions of water characteristics when determining toxicity of ammonia and possibly many other substances.
W81-02496

SEAWATER COOLING TOWER SHOWS FEW PROBLEMS IN FIVE YEARS,
R. McGee.
Power Engineering, Vol 85, No 2, p 66-67, February, 1981. 2 Fig.

Descriptors: *Sea water, *Cooling towers, *Powerplants, *Electric powerplants, Water cooling, Cooling water, Atlantic City, New Jersey, Structures, Corrosion.

The first seawater natural draft cooling tower in the U.S. has been in operation at the Atlantic City Electric Company's B. L. England Station for 5 years. Few problems have been experienced, and these were readily corrected. Occasionally, persistent, high, on-shore winds caused salt spray to fall on a 138 kV switchyard downwind of the tower. A screen of large vertical louvers was installed around the base of the tower to protect switchyard equipment from salt buildup. When spray nozzles made of PVC began to crack after 4 years' service, all 2,000 nozzles were replaced. Loosened support rods for splash plates were replaced by stronger stainless steel rods. The tower cools the water to 94.2F, lower than the designed 95.2F. Salt water drift measuring equipment monitors drift rate. No scale buildup or pothole formation in the concrete structure has been observed. All construction joints are coated with epoxy and exposed hardware is made of Monel or stainless steel. (Cassar-FRC)
W81-02552

MARINE BIOTECHNOLOGY AND THE USE OF ARID ZONES,
Commonwealth Scientific and Industrial Research Organization, South Melbourne (Australia). Div. of Chemical Technology.
D. L. Regan.
Search, Vol 11, No 11, p 377-381, November, 1980. 5 Fig, 1 Tab, 13 Ref.

Descriptors: *Phytoplankton, *Saline water, *Arid lands, *Impaired water use, Cultivation, Algae, Nutrients, Waste water treatment, Sea water, *Australia, Ponds, Microorganisms, Marine algae, Marine microorganisms, Mine water.

Cultivation of salt-tolerant phytoplankton and other microorganisms, which is possible in the arid, sunny coastal lands of Australia, may have many useful commercial applications. By controlling the salinity, temperature, nutrients, concentration of particular ions, and dimensions of a pond, desired organisms may be cultivated. Examples are Spirulina and Dunaliella for dried algal material to be used as food or as a source of vitamins, pigments, unsaturated fatty acids, and glycerol. Some phytoplankters produce pharmacologically useful products such as antibiotics, growth regulators, and many others. Fish and shellfish farming may use phytoplankton as a food source. Gums and other polysaccharides with uses in the food industry and in secondary oil recovery have been produced from Xanthamonas campestris. An unexpected application of this technology is recovery of metals from low-grade ores by bacterial leaching and concentration of metals from dilute solutions. Some phytoplankton cultivation techniques have used sewage or seawater–sewage mixtures as sources of nutrients. (Cassar-FRC)
W81-02570

UTILISATION OF SEWAGE SLUDGE ON LAND--THE CADMIUM ANGLE.
Water Services, Vol 84, No 1018, p 717-718, December, 1980. 1 Tab, 2 Ref.

Descriptors: *Sewage sludge, *Cadmium, *Sludge disposal, *Soil amendments, Metals, Heavy metals, Ultimate disposal, Fertilizers, Agricultural chemicals, Absorption, Soil contamination, Path of pollutants, *Impaired water use.

In the United Kingdom current research on cadmium in sludge-treated soil concerns transfer into crops and the food chain. It is important to maintain pH near neutral and avoid Cd accumulating plants, such as lettuce, in soils with excessive metal levels. Cd is most available to crops during the first 6 months after application. This refutes the theory that Cd is chelated and may be released later in massive doses. Sludge containing an average of 20 mg per kg Cd adds 0.04 to 0.08 kg per hectare per year when applied at 2-4 tons per hectare per year dry solids. The maximum recommended level is 0.167 kg per hectare per year. (Cassar-FRC)
W81-02586

SEWAGE SLUDGE HYGIENISATION PLANT SUPPLIES FERTILISER,
Sulzer Bros. Ltd., Winterthur (Switzerland).
O. Luscher.
Water Services, Vol 84, No 1018, p 711-713, December, 1980. 2 Fig, 1 Tab, 2 Ref.

Descriptors: *Irradiation, *Gamma rays, *Sludge treatment, Sterilants, Sewage sludge, Public health, Microorganisms, Viruses, Bacteria, Ultimate disposal, Sludge disposal, Soil amendments, Fertilizers, Animal parasites, Radiation, Waste treatment, Cobalt radioisotopes, Radioisotopes.

Gamma irradiation from a cobalt-60 source has been used since 1973 in a sewage sludge plant in Geiselbullach, Germany, for destroying bacteria, viruses, and parasites so that the sludge would be more desirable as a fertilizer for agricultural land. The plant averages a throughput of 100 cu meters of sewage sludge daily, although rates up to 200 cu meters daily are possible by increasing the source activity. The radioactive source is recharged about once a year. Total costs range from 15.42 DM per cu meter for a 30 cu meter daily throughput to 4.47 DM per cu meter for 150 cu meters per day. Sludge produces no unpleasant odors and is more easily dewatered (53% water versus 78% for non-irradiated sludge). Gas produced in digestion is used to run fans and heat digested sludge. Although salmonellae are present in many sludges applied to agricultural land, irradiated sludge has none. Coliforms decreased, and desirable soil bacteria either increased upon storage or were not adversely affected. Viruses, present in 5% of sludge samples, decreased by a factor of 10 after irradiation. Worm eggs were damaged irreversibly. Irradiated sludge remained almost odorless upon application to fields, unlike thermally pasteurized material. Fields could be worked after only 8 days, compared with 15 days for unirradiated sludge. (Cassar-FRC)
W81-02591

3D. Conservation In Domestic and Municipal Use

MUNICIPAL WATER USE IN NORTHERN COLORADO: DEVELOPMENT OF AN EFFICIENCY-OF-USE CRITERION,
University of Colorado, Boulder.
A. U. White, A. N. DiNatale, J. Greenberg, and J. E. Flack.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185365, Price codes: A07 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Fort Collins, Completion Report No 105, September, 1980. 123 p, 17 Fig, 40 Tab, 27 Ref, Append. OWRT-A-042-COLO(1), 14-34-0001-9006 & 0106.

Descriptors: Conservation, *Water conservation, *Water use efficiency, *Water demand, *Municipal water, *Colorado, Water supply, Social aspects, Water rights, Return flow, *Water metering, Water resources development, Pricing, Water reuse, Northern Colorado cities, Water saving devices, Restrictions, Survey research, Consumer attitudes.

Water shortages, costs of treatment and rapid growth impose severe pressures on urban water utilities, especially those serving smaller cities and towns. In this study of more than two dozen Northern Colorado towns data was acquired on residential water use and the attitudes and perceptions of water officials and managers with regard to water conservation and meeting future demands. In addition, a random mail survey was made of water customers of selected towns to assess the consumers' attitudes toward various water conservation programs and how shortages should be met. The results of this three-pronged effort permitted a comparison of managers' attitudes with those of consumers leading to various recommendations for development of water conservation programs that would be implementable. Recommendations for long-range conservation include universal metering, development of new supplies and water rights, requirements for low-flow devices and native vegetation in new housing areas, increasing block pricing, public education, reuse of water for non-drinking purposes, and possibly restrict growth. Drought contingency plans are a priority need and should include (1) public education of drought and its consequences, (2) installation of water saving devices, (3) implementation of restrictions and allotments, and (4) surcharges on prices for metered services.
W81-02401

DECLINING BLOCK RATES CAN ENCOURAGE WATER CONSERVATION,
East Bay Municipal Utility District, Oakland, CA.
For primary bibliographic entry see Field 6C.
W81-02614

3E. Conservation In Industry

INDUSTRIAL WATER CONSERVATION WITHIN THE GREAT LAKES REGION: AN OVERVIEW,
Great Lakes Basin Commission, Ann Arbor, MI.
L. B. Antosiak, and C. A. Job.
Journal of the American Water Works Associ-

ation, Vol 73, No 1, p 9-12, January, 1981. 2 Tab, 12 Ref.

Descriptors: *Great Lakes, *Water conservation, *Industrial water, Regulations, Conservation, *Water reuse, Water utilization, Cooling water, Water consumption.

Although water in the Great Lakes area is relatively abundant and cheap, industries are recycling and reusing water to save capital and operating costs. Incentives for industry to conserve water are waste water treatment regulations, pricing policies, and sewer surcharges. Two cases are described in which water conservation saved companies $3 million annually. Factors which discourage water conservation are nonproductive cost of alterations to equipment, failure to enforce regulations, increasing energy costs, and the question of environmental benefits versus costs. Decisions on industrial water conservation must be made on a case by case basis. (Cassar-FRC)
W81-02633

3F. Conservation In Agriculture

IMPACT OF AVAILABILITY OF WATER AND COST OF ENERGY INPUTS ON AGRICULTURAL PRODUCTION IN THE OKLAHOMA PANHANDLE,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
H. P. Mapp, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185241, Price codes: A04 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University Completion Report, September, 1980. 63 p, 2 Fig, 17 Tab. OWRT-A-085-OKLA(1), 14-34-0001-9038.

Descriptors: *Water supply, *Water demand, *Cost analysis, *Energy, *Crop production, Agriculture, Water distribution(Applied), Water utilization, Analysis, Costs, Economics, Cost comparisons, Model studies, Estimating, Research and Development, Testing, Forecasting, *Oklahoma.

The study analyzed the economic life of the underground water supply in the Oklahoma Panhandle under two basic sets of assumptions/scenarios. In scenario I, relative prices of inputs and outputs were assumed constant, and the effects of declining water supply on irrigation well yields, pumping costs, and the pattern of irrigated and dryland crop production in the study area were evaluated; the regional linear programming model developed for this analysis selected the dryland-irrigated crop activities combination that maximized net returns to region producers subject to a set of constraints (including projected region production levels). In scenario II, natural gas price was assumed to increase 2%/year relative to prices of other inputs and outputs, and was designed to determine the potential impact of the rising real price of natural gas over the coming years. Solutions of the scenario I model depict a gradual conversion from irrigated to dryland production, with irrigated wheat projected to increase during 1985-89 and gradually decrease thereafter. Under scenario II, irrigated wheat production is projected to decrease steadily to zero by the 2000-09 period. Eventual economic exhaustion of the aquifer appears inevitable unless dramatic increased output price or institutional/technological changes occur. (Zielinski-IPA)
W81-02410

ASSURING SUSTAINED IRRIGATION IN THE NORTHERN GREAT PLAINS BY SOIL-WATER INTERACTION STUDIES,
South Dakota State Univ., Brookings. Water Resources Inst.
C. G. Carlson, J. H. Bischoff, L. O. Fine, and M. H. Sanders.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185258, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, January, 1981. 63 p, 10 Fig, 3 Tab, 11 Ref, 2 Append. OWRT-B-053-SDAK(2), 14-34-0001-8117.

Descriptors: *Irrigation practices, *Great Plains, *South Dakota, *Soil-water-plant relationships, *Electrical conductance, Water properties irrigation, Geographical regions, Aquifers, Regions, Irrigation efficiency, Irrigation effects, Earth-water interfaces, Salinity, Soil water, Moisture, Subsurface waters, Moisture availability, Soil environment, Nature of water, Conductivity.

Many of South Dakota's aquifers contain vast quantities of water, but much of this is (by accepted standards) classified as having high salt and/or sodium hazard. Further, application of these standards (established under acid conditions on soils dissimilar to South Dakota) to South Dakota climate and soil conditions is somewhat suspect. To improve our predictive capability regarding irrigation operation, a broad evaluation of existing irrigation systems was needed. From the broad soil sampling program undertaken, it was apparent that the electrical conductivity (EC) of the soil saturation extract (EC-e) is difficult to predict. The most significant factor determining the EC-e is the EC of the water. Other non-analyzed factors (e.g., soil internal drainage) also contribute to EC-e variability. Only at isolated sites probably inappropriate to irrigation is the total soil salt load considered high enough to cause great concern. Sodium is of greater concern. Results indicate that irrigated field exchangeable sodium percentages (ESP) can be predicted more accurately than EC-e levels, but more refinement/understanding is still needed. The most dangerous present deficiency is inability to predict dispersion and hydraulic conductivities, given a particular ESP and soil type. (Zielinski-IPA)
W81-02423

WATER SYSTEMS AUTOMATION AND MANAGEMENT, PART 2,
D. F. Nelson.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 2-2, p 1-26. 14 Fig.

Descriptors: *Irrigation systems, *Irrigation efficiency, *Irrigation engineering, *Automation, Water management(Applied), Water control, Flow control, Remote control, Reservoirs, Irrigation canals, Water loss, Seepage, Control systems.

More efficient use and better management of irrigation water can reduce water losses and so make more water available for municipal, industrial, and recreational uses now and in the future. Automatic and remote controls are needed for water storage and conveyance systems to improve service to water users, increase efficiency of operation, and reduce cost of operation. The discussion of the need for automation includes descriptions of the functions of various water control structures as they apply to the segments of the total system. The structures include outlet works, spillways, diversion dams and structures, pumping plants, canal checks, pipe systems, turnouts, and wasteways. Upstream control, downstream control, or controlled volume operation may be used to control water supplies. Feedback control and remote control methods offer scope for automation. Basic feedback control systems are designed to return a portion of the output signal to the input of a controller to maintain a prescribed relationship between input and output signals and may be achieved by one of five common modes of control: two-position control; floating control; proportional control; reset action; and rate action. Remote control may be performed manually or by computer. Both methods can be applied to open channel and pipe systems. (Brambley-SRC)
W81-02511

WATER SYSTEMS AUTOMATION AND MANAGEMENT, PART 3,
M. McVay.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 2-3, p 1-13. 4 Tab.

Descriptors: *Irrigation systems, *Irrigation efficiency, *Water management(Applied), Automation, Computers, Water resources, Water districts, Agriculture, Competition, Economic efficiency, Distribution systems, Irrigation districts, Environmental effects.

Increasing demands made on the water resources of the western United States require better water utilization by the agricultural sector. The Water and Power Resources Service has developed tools to enhance irrigation district operations. The Irrigation Management Services Program involves over 171,000 acres in 20 water districts in eight western states, improving irrigation scheduling. Onfarm field irrigation scheduling and distribution system scheduling can be used by districts to improve grower yields and crop quality, lower production costs, lower district operation and maintenance costs, improve criteria for planning and development of future needs, and obtain more favorable environmental impacts. Both scheduling systems may be computer based using irrigation guide, field irrigation schedule, district wide irrigation requirement program or gravity system scheduling systems. Typical computer print-outs for each system are presented. Coordinating water deliveries throughout distribution systems can increase the efficiency of water use. (Brambley-SRC)
W81-02512

WATER SYSTEMS AUTOMATION AND MANAGEMENT, PART 4,
For primary bibliographic entry see Field 7B.
W81-02513

REHABILITATION OF OPEN WATER CONVEYANCE SYSTEMS,
For primary bibliographic entry see Field 8A.
W81-02516

CANAL LININGS AND SOIL SEALANTS,
W. R. Morrison, and H. Johns.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 7-1, p 1-33. 26 Fig, 2 Tab, 16 Ref.

Descriptors: *Soil sealants, *Canal linings, *Irrigation engineering, *Water conservation, *Seepage control, Irrigation systems, Impervious membranes, Concretes, Concrete-lined canals, Asphaltic concrete, Plastics, Synthetic rubber, Water loss.

Conservation of water becomes increasingly important in the western United States as water demands on limited supplies increase. Seepage control in irrigation systems is a prime conservation measure. Lining of canals or placing in pipe has been the policy of the Water and Power Resources Service since 1967. Linings can be classified as compacted earth, hard-surface, and buried or exposed membrane types. Factors to be considered in selecting a lining type include soil type, canal operating capacity and flow velocity, structural stability requirements, water quality, safety requirements, and maintenance needs. The advantages and disadvantages of the hard-surface linings - portland cement concrete and mortar, asphaltic concrete, and soil-cement - are discussed. The disadvantages of exposed membranes are such that they have been used only on an experimental basis. Buried membranes may be asphalt, polyvinyl chloride, polyethylene or synthetic rubber. Subgrade preparation and cover materials for these membranes are discussed. Some soil sealants and methods of seepage measurement are described. (Brambley-SRC)
W81-02517

VEGETATION MANAGEMENT AND PEST CONTROL,
For primary bibliographic entry see Field 4A.
W81-02524

FEASIBILITY OF IRRIGATING WITH WATER FROM SCS FLOODWATER-RETARDING IMPOUNDMENTS,
Science and Education Administration, Chickasha, OK.

R. R. Schoof, and H. Price.
Agricultural Reviews and Manuals ARM-S-12, October, 1980. 9 p, 3 Fig, 2 Tab, 6 Ref.

Descriptors: *Flood-control storage, *Supplemental irrigation, *Oklahoma, Irrigation water, Drought, Water resources development, Water storage, Water loss, Water rights, *Irrigation programs.

Droughts during the summer growing season are frequent in western Oklahoma. Where enough water of suitable quality is available, irrigation can increase production, stabilize income, and eliminate the possibility of forced sale of livestock during an extended drought. The use of water for supplemental irrigation was inventoried at 16 Soil Conservation Service (SCS) floodwater retarding impoundments in a 1,130 square mile reach of the Washita River in southwestern Oklahoma in 1977. Nearly 500 acre-feet of water was applied to over 800 acres during the growing season. All of the farmers involved in the study reported that there had been enough water for the acreage under irrigation. Calculations revealed that in 136 completed floodwater-retarding impoundments within the study reach, there were more than 13,000 acre-feet of potential water storage in sediment pools. When water was released from one impoundment on each of two streams at initial rates of 6.8 and 1.17 cubic feet per second to determine transmission losses, 75 and 44% of the water reached gaging stations 6 and 4.5 miles downstream. A landowner must own part of the flood pool, dam, spillway, or sediment pool to obtain the legal right to use part of the water. (Moore-SRC)
W81-02544

SPRINKLER HEAD WITH AN IMPROVED SLOTTED DRIVE SPOON,
Nelson (L. R.) Corp., Peoria, IL. (Assignee).
K. J. Brunninga.
U.S. Patent No 4,205,787, 7 p, 3 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 995, No 1, p 141, June 3, 1980.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Application equipment, Irrigation efficiency, Irrigation practices, Irrigation operation and maintenance.

A step-by-step rotary sprinkler head has an impact arm with a drive spoon. The drive spoon is of the anti-backsplash type and includes a pull-in reactant surface and a drive-out reactant surface spaced raially and laterally outwardly of the pull-in reactant surface. The pull-in reactant surface has a slot formed in the central portion for enabling a portion of the stream issuing from the sprinkler head outlet to continue its movement into the slot and outwardly without being deflected onto the drive-out surface when the drive spoon is in stream engagement so that the reactant force established on the drive-out surface is reduced in relation to that which would be established by the deflection of the entire stream. (Sinha-OEIS)
W81-02629

SPRINKLER HEAD WITH IMPROVED COMBINED STREAM COHERENCY DIFFUSER AND DISTANCE CONTROL BAFFLE MEMBER,
Nelson (L.R.) Corp., Peoria, IL. (Assignee).
K. J. Bruninga.
U.S. Patent No 4,205,788, 5 p, 4 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 995, No 1, p 141, June 3, 1980.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Application equipment, Irrigation efficiency, Irrigation practices, Irrigation operation and maintenance.

An object of the invention is to provide a combined baffle and diffuser structure which gives the sprinkler the ability to achieve the functional variations heretofore provided by both an adjustable diffuser pin and an adjustable baffle, while at the same time maintaining the reduced radial dimension heretofore provided in baffles of reduced size utilized to replace the diffuser pin. This object is obtained by providing a combined stream coherency diffuser and distance control baffle member which includes an arm portion placed generally vertically having an aperture extending horizontally through one end, a baffle portion extending at generally right angles from the opposite end of the arm portion and a relatively small diffuser portion extending at generally right angles from the free edge of the baffle. The combined stream coherency diffuser and distance control baffle is mounted on the sprinkler body by a pivot assembly. The combined member is stamped from sheet metal, the baffle portion and diffuser portion being bent in relation to the arm portion. A manual engaging tab is also provided as an integral bent portion of the sheet metal for enabling the member to be readily moved into any desired position of adjustment. (Sinha-OEIS)
W81-02630

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

SNOWMELT INFILTRATION AND RUNOFF ON FROZEN GROUND,
Alaska Univ., Fairbanks. Inst. of Water Resources.
For primary bibliographic entry see Field 2A.
W81-02421

RELATION BETWEEN PROPOSED DEVELOPMENTS OF WATER RESOURCES AND SEEPAGE FROM THE ALL-AMERICAN CANAL, EASTERN IMPERIAL VALLEY, CALIFORNIA,
Geological Survey, Tucson, AZ. Water Resources Div.
O. J. Loeltz, and S. A. Leake.
Geological Survey Open-File Report 79-744 (WRI), May, 1979. 83 p, 26 Fig, 1 Tab, 7 Ref.

Descriptors: *Water resources development, *Canal seepage, *Computer models, *California, *Mexico, Surface-groundwater relationships, Streamflow, Water wells, Pumping, Water levels, Aquifer characteristics, Groundwater movement, Groundwater recharge, Forecasting, *Eastern Imperial Valley, *Mexicali Valley, All-American Canal.

A two-layer digital model designed for this study indicated that sealing of the Coachella branch of the All-American Canal would cause an eventual increase in seepage from the All-American Canal of about 15,000 acre-feet annually. Sealing of both the Coachella Canal and the segment of the All-American Canal between Pilot Knob and Drop 1 would result in a lessening of seepage rates from the All-American Canal of 57,000 acre-feet in 1985, but of only 39,000 acre-feet in 2030. Sealing both the Coachella and the All-American Canals would reduce the outflow to Mexicali Valley from 120,000 acre-feet in 1980 to less than 9,000 acre-feet in 2030. The model also indicated that if only the Coachella Canal was sealed, a little less than 40% of water pumped from proposed well fields near the All-American Canal ultimately would be derived from increased seepage from the All-American Canal; between 50 and 60% of the water pumped would be water that otherwise would flow to Mexicali Valley. (USGS)
W81-02465

HYDROLOGIC EFFECTS OF PROPOSED CHANGES IN MANAGEMENT PRACTICES, WINNEBAGO POOL, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
W. R. Krug.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157026, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-107, January, 1981. 19 p, 11 Fig, 2 Ref.

Descriptors: *Reservoir operation, *Low-flow augmentation, *Water levels, *Computer models, *Wisconsin, Simulation analysis, Streamflow, Inflow, Discharge(Water), Precipitation(Atmospheric), Evaporation, Forecasting, Water management(Applied), *Lake Winnebago(WI), Fox River(WI), Wetland preservation.

Three proposed operation plans for the Winnebago pool, Wis., were studied to determine the effects on lake stage and discharge. A digital reservoir simulation model simulated daily lake stage and discharge from the Winnebago pool. Inflow for this simulation was computed from daily discharge, recorded at Rapide Croche Dam, and daily stage, recorded at Oshkosh. This computed inflow is net inflow, combining the effects of streamflow, precipitation, evaporation, and net groundwater inflow. The model adjusted discharge daily to keep lake stage close to the proposed operation plan. By doing this and by lowering the pool level to near the minimum stage in winter, the plan reduced the frequency of stages exceeding the maximum allowed stage. For the 61 years simulated (water years 1918-78), the simulated 7-day, 10-year low flow at Rapide Croche Dam was 1,000 cubic feet per second compared to 900 cubic feet per second for the observed record. The 7-day, 2-year low flow was 1,500 cubic feet per second (simulated) versus 1,600 cubic feet per second (observed). The study showed that discharge from the Winnebago pool could be managed to guarantee a release of up to 1,500 cubic feet per second, but with occasional violations of the minimum stage requirement. (USGS)
W81-02479

WATER RELATED PROBLEMS IN THE COASTAL ZONE OF LOUISIANA,
Louisiana State Univ., Baton Rouge.
R. F. Malone, M. E. Tittlebaum, S. M. Crane, N. S. Sanders, and S. R. Alston.
Louisiana Water Resources Research Institute Technical Report No 7, November, 1980. 155 p, 5 Fig, 3 Tab, 165 Ref. DACW-29-79-C0268.

Descriptors: *Coasts, *Coastal structures, *Channels, *Wetlands, *Watersheds(Basins), *Louisiana, Water resources, Water control, Aquatic plants, Water utilization, Flooding, Wildlife conservation, Dredging, Navigation, Erosion, Saline water intrusion, Subsidence, Water quality, Waste supply, Recreation.

Significant water and related land resources problems were identified and solutions identified and evaluated. The coastal zone was subdivided into nine hydrologic units based primarily on the topography and drainage patterns within them. Thirteen problem areas were identified: aquatic weed growths; conservation of fish and wildlife; flooding; maintenance dredging; navigation; saltwater intrusion; shoreline and beach erosion; subsidence; urban and industrial expansion; water quality; water related recreation; water supply for municipal and industrial use; and wetlands deterioration. For each hydrologic zone, the parishes affected by each problem were identified from published and unpublished reports and other sources. Generalized solutions identified and evaluated for these problems include: for aquatic weed growths - biological, chemical and mechanical controls and habitat manipulation; for flooding - levees, floodwalls, seawalls, channel construction and improvements, pumping stations and non-structural controls; for navigation - new or modified channels; for saltwater intrusion - freshwater diversion, blocking of access canals, saltwater barriers, pumping restrictions, artificially recharging aquifers, and injection of freshwater along a freshwater-saltwater interface; for sedimentation of aquatic habitat - dredging, directional drilling, pipeline installation, corridors, restoration of natural flow patterns, elimination of lateral canals and channelization; for shoreline and beach erosion - revetments, rip-rap, artificial nourishment, groins, jetties, seawalls and bulkheads, breakwaters, levees and revegetation; for subsidence - restricting urban development and land drainage and construction regulations; for urban and industrial expansion - development, construction and zoning practices.

Each solution will have cumulative impacts and associated effects. Their negative aspects can be minimized by the application of non-structural or management techniques, and adherence to the proposed state guidelines for protection of the coastal zone. (Brambley-SRC)
W81-02509

WATER SYSTEMS AUTOMATION AND MANAGEMENT, PART 1,
For primary bibliographic entry see Field 6B.
W81-02510

WATER SYSTEMS AUTOMATION AND MANAGEMENT, PART 2,
For primary bibliographic entry see Field 3F.
W81-02511

WATER SYSTEMS AUTOMATION AND MANAGEMENT, PART 3,
For primary bibliographic entry see Field 3F.
W81-02512

VEGETATION MANAGEMENT AND PEST CONTROL,
F. Oliver, G. Hansen, G. Otto, and F. L. Nibling.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Sessions 12-1 and 12-2, p 1-43. 15 Fig.

Descriptors: *Irrigation systems, *Vegetation effects, *Pest control, *Aquatic animals, *Aquatic weeds, Herbicides, Pesticides, Aquatic plants, Pipelines, Mechanical control, Water distribution(Applied), Weed control, Regulations.

Irrigation systems require management of land weeds, aquatic weeds, and invertebrate animals for the system to function efficiently. All may be managed by preventive, control or recovery methods. Control of land weeds with herbicides is the most common method. The factors influencing herbicide effectiveness include plant factors, environmental factors, and herbicidal factors. The administration of a weed program is discussed and the laws and regulations affecting the use of pesticides are presented, with examples of the consequences of misuse. Control of aquatic weeds is complicated by difficulty of controlling a herbicide in water, and the multiple use interests to be considered. Chemical methods are generally preferred over mechanical methods. Invertebrate animals are problems in both open and closed systems. Sponges, bryozoans, mollusks, and insects in large infestations may significantly reduce water flow or even block pipes. (Brambley-SRC)
W81-02524

FEASIBILITY OF IRRIGATING WITH WATER FROM SCS FLOODWATER-RETARDING IMPOUNDMENTS,
Science and Education Administration, Chickasha, OK.
For primary bibliographic entry see Field 3F.
W81-02544

PROPOSED MODEL POLICIES FOR URBAN DRAINAGE MANAGEMENT.
Canada-Ontario Agreement on Great Lakes Water Quality, Research Program Project No 77-1-47. Research Report No 102, 1980. 51 p, 2 Append.

Descriptors: *Water policy, *Urban drainage, *Urban planning, *Water management, *Drainage programs, Drainage area, Surface runoff, Runoff, Public policy, Drainage, Planning, Community development, Regional development, Municipal water, Drainage systems, Drainage practices, Drainage, Drainage effects, Drainage density, Sewers, Surface drainage, Water quality control, Erosion.

The Urban Drainage Policy Committee was formed in 1977 to propose model policies for controlling flooding, pollution and erosion problems resulting from urban drainage. In the course of this research, five policy proposals were developed and described in detail, covering: (1) municipalities, in coordination with the conservation authorities, should develop master drainage plans for all watersheds within their boundaries; (2) municipalities with sewage collection and treatment systems should formulate and implement a comprehensive pollution control strategy that considers both wet and dry weather pollution sources; (3) drainage systems for all new development should be designed using the major-minor concept, which recognizes the drainage system's dual role of providing convenience during minor (high frequency) runoff events and minimizing property damage and protecting life during major (rare) runoff events; (4) proponents of new urban developments should indicate the effects of the development on the watershed and carry out mitigative measures as required; and (5) proponents of new urban developments should plan for and carry out an erosion and sediment control program in the planning and construction stages of development, and follow this with an adequate maintenance program. (Zielinski-IPA)
W81-02546

4B. Groundwater Management

MAPS SHOWING GROUNDWATER CONDITIONS IN THE LOWER SAN PEDRO BASIN AREA, PINAL, COCHISE, PIMA, AND GRAHAM COUNTIES, ARIZONA--1979,
Geological Survey, Tuscon, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02450

GROUNDWATER APPRAISAL IN NORTHWESTERN BIG STONE COUNTY, WEST-CENTRAL MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02454

APPRAISAL OF POTENTIAL FOR INJECTION-WELL RECHARGE OF THE HUECO BOLSON WITH TREATED SEWAGE EFFLUENT--PRELIMINARY STUDY OF THE NORTHEAST EL PASO AREA, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
S. Garza, E. P. Weeks, and D. E. White.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $5.50 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 80-1106, September, 1980. 38 p, 6 Fig, 4 Tab, 13 Ref, 1 Plate.

Descriptors: *Artificial recharge, *Treated water, *Sewage effluents, *Injection wells, *Texas, Water reuse, Aquifer characteristics, Water levels, Water quality, Computer models, Methodology, Chemical analysis, *Hueco bolson, *El Paso.

The U.S. Geological Survey, in cooperation with the Texas Department of Water Resources, made a preliminary study of specific factors related to recharging the Hueco bolson in the northeast El Paso area with treated sewage effluent. The city is interested in the location and spacing of injection wells relative to (1) maintaining the injected effluent in the aquifer for a predetermined amount of time (residence time) before it is pumped out, (2) recovery by pumping of as much of the injected effluent as possible, and (3) the long-term effects of injection on water-level declines. A two-dimensional digital-computer model was developed to project short-term hydraulic gradients under various conditions of pumping and injections. A corresponding range of interstitial velocities (294-773 feet per year) was estimated by assuming idealized piston-type flow. These velocities may be used to plan the location and spacing of production and injection wells under assumed time factors related to the required residence time for the injected water. The injection sites were selected near a proposed sewage-treatment facility in an area that will allow flexibility in the locations of the production and injection wells. Maximum 20-year declines of about 35 feet were projected for areas several miles west and southwest of the facility under anticipated injection and pumping rates. The proposed injection water will require strict water-quality controls, which may involve chlorination and the removal of suspended solids. Mixing of the proposed injection water with the native groundwater probably will not clog the aquifer by mineral precipitation. The relatively large concentrations of sodium in the injection water may reduce the hydraulic conductivity of the clay layers in the aquifer, but the permeable sands should not be seriously affected. Plans for an artificial-recharge program need to include an experimental installation to evaluate the system under field conditions. (USGS)
W81-02458

SUMMARY APPRAISALS OF THE NATION'S GROUNDWATER RESOURCES--CARIBBEAN REGION,
Geological Survey, San Juan, PR. Water Resources Div.
F. Gomez-Gomez, and J. E. Heisel.
Available from Supt. of Documents, GPO, Washington, DC 20402. Geological Survey Professional Paper 813-U, 1980. 32 p, 19 Fig, 4 Tab, 51 Ref.

Descriptors: *Groundwater resources, *Virgin Islands, *Puerto Rico, *Regional analysis, *Evaluation, Water resources development, Islands, Groundwater availability, Water supply, Water quality, *Caribbean Region.

Aquifers constitute a valuable resource in the Caribbean Region. In Puerto Rico, groundwater withdrawals are estimated at 357 cubic hectometers per year or 38% of all freshwater use, excluding hydroelectric power generation. In the U.S. Virgin Islands groundwater withdrawals are estimated at 1.9 cubic hectometers per year, or 10% of all freshwater used, including desalinated seawater. Excluding desalinated water, groundwater supplies 71% of U.S. Virgin Islands needs. By 1985 it is estimated that groundwater withdrawals will increase to 430 cubic hectometers per year in Puerto Rico, and 4.5 cubic hectometers per year in the U.S. Virgin Islands. Groundwater will continue to be important in the Caribbean Region. To meet future needs it is necessary to apply effective hydrologic principles in managing the total water resource (surface and subsurface supplies). Only through such an approach can optimum use of the water resources be achieved. Optimum use can be accomplished through conjunctive use of surface and groundwaters and implementation of conservation practices. (USGS)
W81-02473

WATER RESOURCES AND GEOLOGY OF THE LOS COYOTES INDIAN RESERVATION AND VICINITY, SAN DIEGO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
A. P. Ballog, Jr., and W. R. Moyle, Jr.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $7.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-960, October, 1980. 25 p, 4 Fig, 8 Tab, 26 Ref.

Descriptors: *Groundwater resources, Hydrogeology, *Available water, *Water yield, *Indian reservations, *California, Precipitation(Atmospheric), Streamflow, Water quality, Chemical analysis, Water wells, Drillers logs, Groundwater potential, Hydrologic data, Data collections, Evaluation, *Los Coyotes Indian Reservation, *San Diego County(CA).

The water resources of the Los Coyotes Indian Reservation, San Diego County, Calif., are sufficient to supply the limited domestic and stock-water needs of the present residents of the reservation. Surface-water runoff is derived from direct precipitation on the area and from intermittent spring flow. Groundwater occurs in the alluvial deposits and in the consolidated rocks where they are highly fractured or deeply weathered. The best

potential for groundwater development on the reservation is in the small alluvial basins in the San Ysidro and San Ignacio areas. Most water on the reservation is good to excellent in chemical quality for domestic, stock, and irrigation use. Water from two wells (and one spring), however, exceeds the primary drinking-water standard for nitrate plus nitrate. (USGS)
W81-02487

A GEOLOGIC APPROACH TO ARTIFICIAL RECHARGE SITE SELECTION IN THE FRESNO-CLOVIS AREA, CALIFORNIA,
Science and Education Administration, Fresno, CA. Water Management Research.
D. Cehrs, S. Soenke, and W. C. Bianchi.
Technical Bulletin No 1604, January, 1980. 76 p, 62 Fig, 9 Tab, 64 Ref.

Descriptors: *Artificial recharge, *Groundwater recharge, *Site selection, *California, Computers, Groundwater basins, Sedimentary structures, Alluvial fans, *Groundwater management, Subsurface mapping, Groundwater hydrology, Well logs.

In areas of alluvial sediments, the potential for the recharge of surface waters varies with the characteristics of the sediments and the total amount of area exposed to rechargeable water. The best available geologic sites with easy access to rechargeable water and which are hydraulically above the area of need are identified and located using surface and subsurface sedimentary geology. By using cursory survey techniques on geologic and soils maps, initial areas with good surface recharge potentials can be identified. Computer averaged water well logs can be used to delineate the subsurface. This subsurface data, used in conjunction with the surface material data, will demarcate the best potential areas for basins. Some areas with poor surface potential may have excellent subsurface recharge potential and be excellent sites for recharge wells. The final siting decision should be based on the hydraulic data, as the recharge efficiency and its economic criteria are controlled by the percolation rates of the surface and subsurface strata. The alluvial geology and related hydrology of the Fresno-Clovis, California, area were studied in relation to artificially recharged water and ground water dynamics. (Moore-SRC)
W81-02508

DRAINAGE OF IRRIGATED LANDS,
For primary bibliographic entry see Field 8A.
W81-02525

GROUNDWATER MANAGEMENT WITH FIXED CHARGES,
Petroleos de Venezuela, Caracas. Exploration Dept.
E. Aguado, and I. Remson.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR2, p 375-382, July, 1980. 2 Fig, 1 Tab, 14 Ref.

Descriptors: *Installation costs, *Water management(Applied), *Groundwater management, Water wells, Drainage wells, Excavation, Planning, Hydrology, Economics, Costs, Project planning, Construction costs, Optimization, Linear programming.

In previous work groundwater variables (hydraulic head, hydraulic conductivity, discharge or recharge rate per unit area, etc.) were used in a model to determine the optimal plan for maintaining an excavation site in a dewatered state. This paper introduces the 'setup cost' or the cost of installation of the required wells into the equations. This cost is significant when the life of the project is relatively short. In a solution of a modeling study with 10 wells around an excavation site, the optimal solution (including fixed installation charges) was to use 8 wells at a 9% higher pumping rate. (Cassar-FRC)
W81-02605

4C. Effects On Water Of Man's Non-Water Activities

WATER RELATED PROBLEMS IN THE COASTAL ZONE OF LOUISIANA,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 4A.
W81-02509

4D. Watershed Protection

WATER USE, GROUNDWATER CONDITIONS, AND SLOPE FAILURE ON BENCHLANDS IN WESTERN MONTANA: THE DARBY SLIDE EXAMPLE,
Montana Univ., Missoula.
For primary bibliographic entry see Field 2J.
W81-02494

SLOT MULCH FOR RUNOFF AND EROSION CONTROL,
Science and Education Administration, Pullman, WA.
K. E. Saxton, D. K. McCool, and R. I. Papendick.
Journal of Soil and Water Conservation, Vol 36, No 1, p 44-47, January/February, 1981. 5 Fig, 19 Ref.

Descriptors: *Cultivation, *Erosion control, *Runoff, Furrows, Crops, Mulches, Infiltration rates, Soil physical properties, Soil management, Surface sealing, Frozen soils.

A slot mulch method of tillage and residual management was developed to control erosion and runoff on land where infiltration is restricted by frost or soil characteristics. Crop residues were compacted into narrow continuous slots 2 to 4 inches wide by 8 to 10 inches deep. The soil was ridged on the down-slope side. The slot works best when installed on the contour, and the residual mulch maintained a good microporosity for water infiltration even when the soil was frozen or the surface became crusted and sealed. The slot depth was kept below the frost depth. During runoff, the water ran into the slot and down through the residue. Tests were conducted on four different runoff-erosion plots, each 12-ft wide and 73-ft long, near Pullman, Washington. The method controlled runoff and erosion to a significant extent except when the frost depth extended below the slot depth. The method could be effective on critical erosion areas such as steep slopes planted in grass or having exposed subsoil. (Small-FRC)
W81-02638

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DISTRIBUTION OF TRACE ELEMENTS IN A WARM WATER RELEASE IMPOUNDMENT,
Arkansas Water Resources Research Center, Fayetteville.
J. Nix.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185373, Price codes: A08 in paper copy, A01 in microfiche. Completion Report, October, 1980. 49 p, 22 Fig, 4 Tab, 12 Ref, 66 Append. OWRT-B-027-ARK(1).

Descriptors: *Water analysis, *Water quality, *Trace elements, Data collections, *Impoundments, Monitoring, Baseline studies, Turbidity, Water chemistry, Water temperature, Water properties, Basic data collections, On-site data collections, Measurement, Calcium, Dissolved oxygen, Biochemical oxygen demand, Iron, Manganese, *Arkansas, DeGray Reservoir.

The results of a detailed water quality survey conducted over 1969-1975 on DeGray Reservoir in southwest Arkansas were used to describe physical/chemical processes affecting reservoir and river system constituent concentrations. Dissolved oxygen (DO) and turbidity profiles delineated water movement through the reservoir. Development of metalimnetic DO minima appeared as related to advective transport within the metalimnion (with metalimnetic DO depletion greatest during years when Spring rains occurred after stratification onset). Dissolved oxygen data showed new reservoir 'aging' (with hypolimnetic DO depletion severe during early impoundment years, but moderated after four years). Iron (Fe) and manganese (Mn) expectedly correlated well with DO depletion; other trace metals studied did not correlate with either Fe or Mn. Cobalt correlated significantly with nickel, probably due to their geochemical similarity. Storm event intervention was the most significant factor determining concentrations of calcium and other conservative constituents. Calcium dropped as storm water entered the reservoir. Other constituents, including phosphorus and suspended solids, increased in storm water. (Zielinski-IPA)
W81-02402

APPENDICES FOR DISTRIBUTION OF TRACE ELEMENTS IN A WARM WATER RELEASE IMPOUNDMENT,
Arkansas Water Resources Research Center, Fayetteville.
J. Nix.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185381, Price codes: A06 in paper copy, A01 in microfiche. Completion Report, October, 1980. 103 p, 100 Append. OWRT-B-027-ARK(1).

Descriptors: *Water analysis, *Water quality, Data collections, *Trace elements, *Impoundments, Monitoring, Baseline studies, Turbidity, Water chemistry, Water temperature, Water properties, Basic data collections, On-site data collections, Measurement, Calcium, Dissolved oxygen, Biochemical oxygen demand, Iron, Manganese, *Arkansas, Lake DeGray.

This document contains 98 appendices of data on measurements taken at various designated monitoring/sampling stations for Lake DeGray in south-central Arkansas. Graphs given in appendices 2-12 show turbidity profiles over depths ranging from about 5-50 meters over five stations during May-December, 1971. Dissolved oxygen profiles are given for various test days from October 1969 to July 1974 in appendices 13-66. Appendices 2-66 also appear in the principal report document for this study (see W81-02402). The remaining appendices (67-100) are tabular data sets from stations 1, 10, and 12, generally covering depths from 0-50 meters (m), 0-25 m, and 0-15 m, respectively. Water temperature data: appendices 66-67 (1970-75); dissolved oxygen: 68 (1970-75); turbidity (percent transmission): 69 (1971-75); pH: 70 (1970-75); alkalinity: 81 (1971-75). The remaining appendices (72-100) contain tabular data on individual trace elements within the period 1970-1975 for the following elements: sodium, potassium, calcium, magnesium, silicon, ammonium ion, nitrate, orthophosphate, sulfate, fluoride, chloride, iron, manganese, copper, cobalt, nickel, zinc, lead cadmium, and arsenic. (Zielinski-IPA)
W81-02403

TRACE METAL CONCENTRATIONS IN SEDIMENT CORES FROM THE CONTINENTAL SHELF OFF THE SOUTHEASTERN UNITED STATES,
Geological Survey, Woods Hole, MA.
M. H. Bothner, P. J. Aruscavage, W. M. Ferrebee, and P. A. Baedecker.
Estuarine and Coastal Marine Science, Vol 10, No 5, p 523-541, May, 1980. 2 Fig, 6 Tab, 28 Ref.

Descriptors: *Trace elements, *Heavy metals, *Sediments, *Continental shelf, Baseline studies, Southeast United States, South Carolina, Atlantic Ocean, Cores, Sampling.

A baseline for 32 trace metal concentrations in sediment cores taken from the Southeast U.S. con-

tinental shelf (in the area of South Carolina from about 30 to 34 degrees latitude) was established. Metal concentrations were low and uniform with depth. There was no evidence of anthropogenic deposition, either at the water-sediment interface or at deeper levels. Small variations in metal levels were attributed to texture variations and to differing amounts of calcium carbonate and organic matter. Both long (6 meter) and short (70 cm) cores were collected, the shorter ones used to analyze the surface sediments. Cores were 99.9% sand and contained very little organic carbon. (Cassar-FRC)
W81-02427

WATER QUALITY CHANGES DURING DISTRIBUTION,
Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
A. H. Vajdic.
Ontario Ministry of the Environment Report No 81, September, 1980. 15 p, 4 Tab, 19 Ref.

Descriptors: *Water purification, *Water quality, *Water distribution(Applied), Water sources, Water wells, *Water treatment, Water analysis, Lake Ontario, Chlorination, Coagulation, Settling basins, Filtration, Baseline studies, Domestic water, Reclaimed water, Bodies of water, Groundwater, Groundwater basins, Watersheds(Basins), Great Lakes, Surface waters, Water quality control, Water pollution.

Six plants and distribution systems were studied: three treating Lake Ontario water (employing a full treatment regime of prechlorination, settling, coagulation, filtration, and free residual post-chlorination, before distribution); three using groundwater from wells (using either filtration and chlorination, or no treatment but with hypochlorite solution disinfection). No significant changes occurred in the chemical parameters studied (pH, turbidity, color, suspended solids, hardness, alkalinity, iron, manganese, ammonia, Kjeldahl nitrogen, nitrate, nitrite, chloride, phenol, sulfate, total organic carbon, and B.O.D.). Total bacteria count did not correlate with coliform occurrence, other indicators, or amount or type of chlorine residual. Temperature did not significantly correlate with total bacteria count, but distribution systems temperatures exceeded those at which bacterial growth would be expected. The presence/absence test was found to be more sensitive for coliform detection than the membrane filter test. (Zielinski-IPA)
W81-02444

CHEMICAL QUALITY OF WATER FROM COMMUNITY SYSTEMS IN NEW YORK, NOVEMBER 1970 TO MAY 1975,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02477

FLAMELESS ATOMIC ABSORPTION FOR TRACING THE FATE OF HEAVY METALS IN SOILS AND GROUNDWATER,
Montana State Univ., Bozeman. Dept. of Civil Engineering.
R. L. Sanks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-189821, Price codes: A04 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Montana State University Report No 111, September, 1980. 55 p, 18 Fig, 7 Ref. OWRT-A-109-MONT(1), 14-34-0001-8028.

Descriptors: *Chemical analysis, *Heavy metals, Methodology, Analytical technique, Temperature, *Pollutant identification, Aqueous solution, Soil contamination, *Atomic absorption, Instrumentation, Detection.

A Varian AA-5 atomic absorption unit for measuring trace metals in soils and aqueous solutions was modified to improve the accuracy of the results and to reduce interference from matrix substances. A Woodriff Constant Temperature Furnace (WCTF) was added to simplify and speed analysis and to permit direct introduction of soil samples without tedious chemical pretreatment. The attempted modifications led to a complete redesign of an atomic absorption unit for performing the analysis of metals in soils. The new instrument is dependable and versatile. Liquid or soil samples may be analyzed with no chemical pretreatment. The standard error of analysis obtainable (1) for liquid samples is 5% at the 95% confidence level and (2) for soil samples is 7% at the 95% confidence level. These accuracies are not obtainable by current commercial models. Calibration curves for cadmium and zinc were established; techniques for sampling and performing direct analysis were developed.
W81-02491

ARE PUBLIC AND RECREATIONAL WATER SUPPLIES IN MONTANA SAFE FROM YERSINIA ENTEROCOLITICA GASTROENTERITIS,
Montana Univ., Missoula. Dept. of Microbiology.
M. J. Nakamura.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-189839, Price codes: A02 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Montana State University, Bozeman Report No 108, Bozeman, 1980. 10 p, 1 Tab, 9 Ref. OWRT A-104 MONT(1), 14-34-0001-8028.

Descriptors: *Water quality, Water supply, *Pathogenic bacteria, Public health, *Potable water, Yersinia enterocolitica, Water-borne gastroenteritis, *Montana, Recreational water supply.

Yersinia enterocolitica has been implicated as the causative agent in numerous water-borne gastroenteritis. The detection system for this pathogenic bacterium is not widely used in the sampling of water supplies. Because some of the sources of previous human exposure have been drinking water supplies, this study was undertaken to sample and study public water supplies, e.g., drinking-fountains in public rest areas on interstate highways, public camp grounds, public swimming pools, surface waters, rivers, streams, and irrigation ditches. Of the 89 samples collected, only a few yield Yersinia enterocolitica. Montana is relatively free and safe from Yersinia enterocolitica contamination, at least, during the summer months. Studies of water samples should be expanded to include water collected during the winter months. Continued surveillance of water samples is necessary because the quality of water is subject to change from time to time as the conditions change.
W81-02492

A WATER QUALITY STUDY OF PLACID LAKE AND ITS DRAINAGE,
Montana Univ., Missoula. Dept. of Chemistry.
R. E. Juday, and E. J. Keller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-189847, Price codes: A04 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Montana State University, Bozeman Report No 110, Bozeman, 1980. 62 p, 13 Fig, 25 Tab, 28 Ref. OWRT A-087-MONT(1), 14-31-0001-5026.

Descriptors: Water quality, *Nutrients, *Productivity, *Lakes, Lake morphometry, Dissolved oxygen, Phytoplankton, Zooplankton, Inorganic compounds, Mesotrophy, Oligotrophy, Microbiology, Western Montana, Clearwater lakes, Trophic classification, National Eutrophication Study(NES).

Water quality data acquired over a four-year period from 1974 through 1977 from Placid Lake and other waters of the Clearwater River drainage in western Montana were used to determine and describe the trophic states of six of the lakes in the drainage. In addition, data from seven other lakes were obtained in 1976 that were used to estimate their trophic states. Trophic states were established principally on the basis of summer and winter oxygen depletion rates, summer chlorophyll a levels, and transparency measurements. Three of the lakes were oligotrophic, four oligomesotrophic, and the remainder mesotrophic.
W81-02493

IDENTIFICATION AND DETECTION OF WATER-BORNE VIRUSES BY IMMUNOENZYMATIC METHODS,
Harvard School of Public Health, Boston, MA.
J. E. Herrmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-224249, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/4-80-034, June, 1980. 44 p, 3 Fig, 15 Tab, 34 Ref. R-803360.

Descriptors: *Viruses, *Assay, Water pollution, *Coxsackie virus, *Enteroviruses, *Pollutant identification, Waste water analysis, Public health, Water analysis, Immunoassay.

A quantitative enzyme-linked immunosorbent assay (ELISA) was used for identification of viruses selected as representative water-borne viruses: poliovirus 1, echovirus 6, coxsackievirus A9, and coxsackie B viruses. Partially purified viral antigens or virus-specific antibodies were adsorbed to polystyrene spectrophotometer cuvettes, which permitted the assays to be reported and compared in terms of enzyme units specifically reacting. Inhibitors in diluents used to prevent non-specific adsorption of immunoreagents caused desorption of virus or antibody during an immunoassay; the amount of virus desorption varied with the type of preparation used, and antibody desorption was dependent on the concentration of antibody initially adsorbed. For specific identification of a given enterovirus type by this ELISA method, approximately 1,000,000 plaque-forming units of virus per assay tube were required. To alleviate the problem of antibody and virus desorption, antibodies and virus were immobilized by covalent linkage on nylon balls for use in solid-phase enzyme-linked immunoassays. A higher percentage of virus could be immobilized by this method than was possible by adsorption to polystyrene, and enzyme-linked immunoassay on nylon was sufficiently specific to differentiate the three poliovirus types. (Author's abstract)
W81-02528

MARSH CREATION: IMPACT OF PESTICIDES ON THE FAUNA, USE OF INFRARED PHOTOGRAPHY, DITCHING AND DIKING,
Georgia Dept. of Natural Resources, Brunswick, Coastal Resources Div.
For primary bibliographic entry see Field 5C.
W81-02539

A REVISED ESTIMATE FOR TRACE METAL FLUXES TO NARRAGANSETT BAY: A COMMENT,
Lamont-Doherty Geological Observatory, Palisades, NY.
P. H. Santschi.
Estuarine and Coastal Marine Science, Vol 11, No 1, p 115-118, July, 1980. 2 Tab, 19 Ref.

Descriptors: *Metals, *Sediments, *Narragansett Bay, *Trace elements, Pollutant identification, Lead, Copper, Zinc, Chromium, Water pollution, Rhode Island.

The author states that neglecting bioturbation of sediments in Narragansett Bay led to gross overestimation of anthropogenic trace metal fluxes as determined by Goldberg et al (1977). Examples (measured in micrograms per sq cm per year) are as follows: lead--old value 168, new value 15.7; zinc--330 old, 24.8 new; copper-260 old, 24.8 new; and chromium--219 old, 13.9 new. Natural fluxes were about 50% of Goldberg's values. The equation used to calculate the new values was: Flux = (concentration in top layer - concentration in bottom layer) times sediment accumulation rate. (Cassar-FRC)
W81-02549

A REVISED ESTIMATE FOR TRACE METAL FLUXES TO NARRAGANSETT BAY: A REPLY,
Scripps Institution of Oceanography, La Jolla, CA.

E. D. Goldberg, and M. Koide.
Estuarine and Coastal Marine Science, Vol 11, No 1, p 119, July, 1980. 3 Ref.

Descriptors: *Metals, *Sediments, *Narragansett Bay, *Trace elements, Rhode Island, Pollutant identification, Water pollution.

Goldberg replies to a comment on his 1977 paper on trace metal fluxes to Narragansett Bay by remarking that he still prefers his proposed chronology for the cores, that the changes which he determined in heavy metal concentrations with time are similar to those in other highly industrial areas, and that movement of sediment components could not take place through a solid layer of shells. (Cassar-FRC)
W81-02550

PRESERVATION OF WATER SAMPLES.
Deutsche Gesellschaft Chemiker, Essen (Germany, F.R.). Fachgruppe Wasserchemie.
Water Research, Vol 15, No 2, p 233-241, February, 1981. 3 Fig, 5 Tab, 34 Ref.

Descriptors: *Preservation, *Water samples, *Mathematical studies, *Water analysis, Storage, Statistical analysis, Municipal wastes, Domestic wastes, Laboratory tests, Stability, Reliability, Data collections, Quality control.

The working party on the stabilization of samples of the German Chemists Association's hydrochemistry team has conducted tests on the preservation of samples of sedimented municipal effluent. The preservation techniques employed included deep-freezing, addition of alkali or acid, chloroform, and mercuric chloride. Round robin tests were conducted by several German laboratories on domestic effluent samples sedimented for 2 hours before treatment with the preservative to quantify the reliability of each preservation method. The six year studies also utilized the NALIMOV maverick test to determine whether the data material from one test day, which is assumed to show a normal arithmetic distribution, contains statistical mavericks. Use of this statistical tool ensures that results of statistical evaluations of the round robin tests take into account the practical facilities of each participating laboratory. From these investigations tables were generated of parameters that may or may not be preserved successfully by the methods studied. The recommended durations in days for each water parameter are also listed. (Geiger-FRC)
W81-02577

IDENTIFICATION OF ORGANIC SULFUR COMPOUNDS AND POLYCYCLIC HYDROCARBONS TRANSFERRED TO SHELLFISH FROM PETROLEUM SUSPENSION BY CAPILLARY MASS CHROMATOGRAPHY,
Okayama Univ. Medical School (Japan). Dept. of Public Health.
M. Ogata, and Y. Miyake.
Water Research, Vol 15, No 2, p 257-266, February, 1981. 5 Fig, 3 Tab, 11 Ref.

Descriptors: *Bioindicators, *Oil pollution, *Clams, Water pollution, Oil wastes, Oil spills, Adsorption, Analytical techniques, Gas chromatography, Pollutant identification, Organic compounds, Mass spectrometry, Shellfish, Sulfur compounds.

Short-necked clams (Tapea Angdala phillipinarum) were kept in laboratory tanks containing 250 milligrams/liter of crude oil suspension for 15 days to study the concentration factors of the water pollutants in the soft body tissues of these shellfish. The organic sulfur and polycyclic hydrocarbon compounds in clam extracts were also analyzed by capillary gas chromatography-mass spectrometry. Organic sulfur compounds of alkyl-benzothiophenes (C1-C6) and dibenzo-thiophene and alkyl-dibenzothiophenes (C1-C4) were present as markers of oil pollution of the clams. Gas chromatography with flame ionization detection (FID) was used to determine concentration factors of the organic sulfur compounds over the time duration of the experiment. Other aromatic compounds from the oil suspension such as naphthalene, alkyl-naphthalenes, phenanthrene, alkyl-phenanthrenes, pyrene and alkyl-pyrenes were also detected in the soft body tissues of the clams. Since trace amounts of organic sulfur compounds could be detected by FID gas chromatography, these substances are recommended for use as markers of oil pollution in fish. (Geiger-FRC)
W81-02578

DIRECT ANALYTICAL METHOD FOR ALIPHATIC COMPOUNDS IN WATER BY STEAM CARRIER GAS CHROMATOGRAPHY,
Yokohama National Univ. (Japan). Dept. of Safety and Environmental Engineering.
K. Urano, K. Ogura, and H. Wada.
Water Research, Vol 15, No 2, p 225-231, February, 1981. 13 Fig, 1 Tab, 11 Ref.

Descriptors: *Gas chromatography, *Organic compounds, *Pollutant identification, Analytical techniques, Water analysis, Separation techniques, Solubility, Temperature, Alcohols, Ethers, Ketones, Aldehydes, Organic wastes, Acids.

The influence of the carrier flowrate and column temperature on the separation characteristics of steam carrier gas chromatography (SCGC) was examined using Chromosorb P AW modified with phosphoric acid. The SCGC technique is useful in detecting polar organic compounds at minute levels in water samples. Optimum flowrates for analyzing water samples containing several groups of aliphatic compounds were approximately 60 ml/minute of carrier steam while the best temperature range for the determination was from 150 to 180 degrees. Relationships were obtained between the retention time and the boiling point of soluble and slightly soluble groups. When the retention time of an aliphatic compound is known, it is possible to predict its boiling point and solubility. Conversely, the retention time of a compound may be estimated if its boiling point and solubility are known. The relative peak area was found to increase proportionally with increasing carbon number of the compound. Many aliphatic and some polar compounds present in water samples at levels greater than 40 micrograms/liter may be analyzed directly by SCGC without pretreatment measures. (Geiger-FRC)
W81-02579

COMPARATIVE STUDY OF MEMBRANE FILTRATION METHODS FOR THE ISOLATION OF GROUP D STREPTOCOCCI FROM WATER,
Rijksinstituut voor de Volksgezondheid, Bilthoven (Netherlands).
A. H. Havelaar, and H. W. B. Engel.
Water Research, Vol 15, No 2, p 191-197, February, 1981. 2 Fig, 5 Tab, 12 Ref.

Descriptors: *Pollutant identification, *Coliforms, *Isolation, Filtration, Separation techniques, Water pollution, Bioindicators, E. coli, Streptococcus, Pathogenic bacteria, Temperature, Water quality, Sewage bacteria, Water quality standards.

Traditionally, the testing of water samples for the presence of Escherichia coli was considered an adequate screening method for detecting fecal pollution. However, since this organism exhibits a low survival rate outside of the gastrointestinal tract, tests for other, more persistent indicator organisms such as fecal streptococci are advocated. A comparative study of isolation methods for the group D streptococci was organized by the Netherlands National Institute of Public Health. Nine laboratories collaborated in evaluating the efficiency of two membrane filtration media (KF-streptococcus agar and bile esculin azide agar) for isolation of bacteria from sewage, secondary effluent, chlorinated effluent, surface water, stored water and almost fully treated drinking water. Bacterial isolations were carried out at 37 and 44C. Organisms subcultured from the media were classified as group D streptococci if they were catalase negative and able to grow at 45C. Significantly fewer group D streptococci colonies were formed on bile esculin azide agar than on KF. Neither medium exhibited improved selectivity by incubation at 44C instead of 37C. At 44C, recovery was significantly reduced, especially if the bacteria were damaged by chlorine. For membrane filtration, KF-streptococcus agar at 37C was recommended. (Geiger-FRC)
W81-02581

POLAROGRAPHIC MEASUREMENT OF SURFACE-ACTIVE MATERIAL IN NATURAL WATERS,
University of East Anglia, Norwich (England). School of Environmental Sciences.
K. A. Hunter, and P. S. Liss.
Water Research, Vol 15, No 2, p 203-215, February, 1981. 16 Fig, 3 Tab, 29 Ref.

Descriptors: *Surfactants, *Polarographic analysis, Analytical techniques, *Pollutant identification, Estuaries, Salinity, Organic compounds, Surface waters, Sea water, Suspended solids, Water pollution.

An electrochemical procedure for the determination of the effective concentration of natural and man-made surface-active agents in natural waters is described. The method is based on the surfactant suppression of the polarographic streaming maximum which occurs on the reduction wave of Hg(II) in aqueous solution. The effects of depolarizer concentration, Hg reservoir height, drop time, and temperature on the process were studied. When a calibration graph prepared with Triton X-100 was used to determine surfactant activities in seawater samples, the overall precision showed a variation coefficient of 3%, which included blank corrections. The maximum peak current decreased exponentially with salinity, allowing correction of the current values for estuarine samples to a constant salinity of 33.43%. When seawater and river water are mixed, the determined surfactant activity is a conservative property which is unaffected by flocculation for a few days. The technique has been applied to estuarine water, coastal seawater and surface microlayer samples. Surface layer samples were enriched in surfactant matter compared to subsurface waters. In many instances, the present method may be used as a substitute for dissolved organic carbon (DOC) determinations. In general, good correlations were found between results from the polarographic technique and DOC levels from many different estuarine samples. (Geiger-FRC)
W81-02582

THE LINEAR PLOT: A NEW WAY OF INTERPRETING TITRATION DATA, USED IN DETERMINATION OF WEAK ACIDS IN LAKE WATER,
Swedish Water and Air Pollution Research Lab., Goeteborg.
Y. H. Lee.
Water, Air, and Soil Pollution, Vol 14, p 287-298, 1980. 4 Fig, 6 Tab, 12 Ref.

Descriptors: *Volumetric analysis, *Lakes, *Fulvic acids, Acids, *Pollutant identification, Analytical techniques, Hydrogen ion concentration, Organic acids, Chemical properties.

The concentration and pK value of monobasic weak acids such as fulvic acid may be simultaneously determined in lake water using a method based on a linear plot of Brosset's function for the slope of Gran's plot. This titration method is applicable to monobasic weak acids with pK 4 to 9 even in the presence of a strong acid. All colored lake water samples studied contained a weak acid with pK 4.4-4.7. Two samples showed the presence of an unknown second acid with pK of 3.4-3.7. (Cassar-FRC)
W81-02592

CONCENTRATIONS OF HEAVY METALS IN FORTY SEWAGE SLUDGES IN ENGLAND,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
R. M. Sterritt, and J. N. Lester.
Water, Air, and Soil Pollution, Vol 14, p 125-131, 1981. 3 Tab, 19 Ref.

Descriptors: *Sewage sludge, *Heavy metals, *Sludge disposal, Metals, Soil amendments, *Pollutant identification, Ultimate disposal, Agriculture, Fertilizers, Land, Cadmium, Cobalt, Chromium, Copper, Manganese, Molybdenum, Nickel, Lead, Tin, Zinc.

Samples of 40 sewage sludges in England were analyzed by flameless atomic absorption spectroscopy to determine 10 heavy metals. Compositions of the sludges varied widely, with concentration ranges over a 100-fold spread. Over 75% of the sludges contained enough zinc, copper and nickel to limit land application to no more than 2 tons per hectare per year. The metal concentrations with their means and ranges, expressed in mg per kg dry weight, were as follows: Cd, 24.8, 1.54-110; Co, 105, 11.3-2490; Cr, 707, 57.2-5190; Cu, 721, 170-2080; Mn, 667, 131-6120; Mo, 16.2, 0.102-214; Ni, 290, 16.2-2020; Pb, 1550, 27.5-45,400; Sn, 57.5, 2.65-329; and Zn, 1930, 93.5-9210. (Cassar-FRC)
W81-02594

MONITORING DEVICE SIMPLIFIES SAMPLE COLLECTION.
Water Well Journal, Vol 34, No 11, p 48-50, November, 1980. 3 Fig.

Descriptors: *Sampling, *Water sampling, *Instrumentation, *Barcad sampler, Water analysis, Pollutant identification, Observation wells, Wells.

The BarCad groundwater sampling instrument is designed to reduce costs and improve the performance of subsurface contaminant studies. The sampler, a porous, hollow cylinder, is permanently contained in a 3 inch borehole. Successive samplers are installed at desired depths and separated by bentonite clay sealers. Water is conducted to the surface through a small diameter riser tube concentric within a larger gas drive tube. Compressed inert gas such as nitrogen activates the sampler. Samples are obtained as slugs of water. The only tools necessary are an adjustable wrench, tank of compressed gas, and sample bottles. (Cassar-FRC)
W81-02596

MICROBIOLOGY OF WATER--QUALITY ASSURANCE,
Environmental Monitoring and Support Lab., Cincinnati, OH.
R. H. Bordner.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1800-1804, June, 1980. 37 Ref.

Descriptors: *Microbiology, *Standards, *Water quality control, *Reviews, Bibliographies, Quality control, Laboratories, Publications, Safety, Bacteria, Microorganisms, Pollutant identification, Analytical techniques.

Recent developments in quality assurance of water include several new publications--a comprehensive source book published by the American Public Health Association, a handbook released by the EPA, a manual from UNESCO, and guides from Canada and the Commission of the European Communities. EPA's laboratory certification program is highlighted. Specific studies on various standards and methods for improving quality assurance include sterilization, multitest systems, staining methods, and statistical problems. Safety precautions and safe working practices in biological laboratories were the subject of several papers. (Cassar-FRC)
W81-02606

MICROBIOLOGY: DETECTION OF BACTERIAL PATHOGENS AND THEIR OCCURRENCE,
Environmental Protection Agency, Cincinnati, OH.
D. J. Reasoner.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1812-1833, June, 1980. 4 Tab, 122 Ref.

Descriptors: *Pathogenic bacteria, *Microbiology, *Reviews, Public health, Bibliographies, Potable water, Water pollution sources, Animal pathology, Pollutant identification, Analytical techniques, Salmonella, Bacteria, Yeasts, Coliforms, Water analysis, Enteric bacteria, Animal diseases.

Recent papers on determination and occurrence of bacterial pathogens are reviewed. Animals are the source of many bacterial pathogens affecting humans. Four tables (E. Coli and Salmonella in warm-blooded animals, Salmonella and Enterobactericeae in cold-blooded animals, Leptospira in animals, and miscellaneous bacterial and opportunistic pathogens in animals) list the animal source, organism, a brief summary, and reference number for about 55 papers. Other sources of bacterial contamination in potable water are distribution system breaks and repairs, cross-connections, back-siphonage, and deficient treatment procedures. New and improved methods of isolating and detecting pathogens are described. (Cassar-FRC)
W81-02609

MICROBIOLOGY OF WATER,
Environmental Protection Agency, Cincinnati, OH.
E. E. Geldreich.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1774-1800, June, 1980. 204 Ref.

Descriptors: *Water analysis, *Microbiology, *Reviews, Pollutant identification, Bioindicators, Recreation facilities, Runoff, Water pollution sources, Ecology, Analytical techniques, Microorganisms, Bacteria, Lakes, Rivers, Sediments, Salmonella, Coliforms, Bibliographies.

A review of the recent literature on microbiology of water discusses microbes as indicators of water pollution, evaluation and improvements in determination of microorganisms, (with a separate section on rapid methods), and microorganisms in the aquatic environment (including rivers, coastal waters, sediments, lakes and impoundments). (Cassar-FRC)
W81-02610

METALS IN NEREID POLYCHAETES: THE CONTRIBUTION OF METALS IN THE JAWS TO THE TOTAL BODY BURDEN,
Marine Biological Association of the United Kingdom, Plymouth (England).
G. W. Bryan, and P. E. Gibbs.
Journal of the Marine Biological Assoication of the United Kingdom, Vol 60, No 3, p 641-654, August, 1980. 3 Fig, 7 Tab, 17 Ref.

Descriptors: *Bioindicators, *Metals, *Nereids, *Zinc, *Pollutant identification, Absorption, Trace elements, Heavy metals, Polychaetes, Sediments, Worms, Invertebrates, Aquatic animals, Benthic fauna, Silver, Copper, Cadmium, Iron, Lead.

Use of Nereids as bioindicators for metal contamination in sediments may not be accurate for zinc, which may have a structural role in the jaw rather than being the result of a detoxification process. Zinc was not evenly distributed within the Nereis virens jaw. The highest level of zinc was found in the distal tip (45,740 micrograms per gram) and the lowest level, 1,790 micrograms per gram, in the basal part. Zinc concentration in the total jaw was 10,130 to 18,360 micrograms per gram dry weight. In small worms, the jaw zinc accounted for over 40% of total body zinc; in larger worms, 30% or less. Analysis of Nereis diversicolor from an uncontaminated site and from a sediment with 16 times the zinc level of the first sample showed no difference in jaw zinc and only a 3-fold increase in body zinc, suggesting that zinc is regulated by the nereid. Other metals detected in Nereis virens were (micrograms per gram dry weight): Na, 1150-2690; Mg, 616-1080; Ca, 531-1130; Fe, 444-1180; Mn, 510-952; K, 270-960; Cu, 4-80; Pb, 8.7; Cd, 0.1; and Ag, less than 0.1. Concentrations of Cu and Ag in whole worms and jaws did reflect sediment levels, but Fe was variable. Jaw Mn contributed over 50% to the total in small worms, decreasing with increasing body size, to 20%. The jaws contained less than 1% of the total body burden of the following metals: Ag, Cd, Cu, Fe, and Pb. (Cassar-FRC)
W81-02615

5B. Sources Of Pollution

EFFECTS OF STRIP MINING THE ABANDONED DEEP ANNA S MINE ON THE HYDROLOGY OF BABB CREEK, TIOGA COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
L. A. Reed.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121337, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-53, August, 1980. 41 p, 16 Fig, 13 Tab, 8 Ref.

Descriptors: *Strip mines, *Acid mine water, *Mine drainage, *Water pollution effects, *Pennsylvania, Acid streams, Water quality, Neutralization, Alkalinity, Water analysis, Sediment discharge, Tioga County(PA), Babb Creek(PA), Daylighting.

Daylighting (strip mining of coal seams previously deep mined) operations are being conducted on the Anna S Mine, that underlies about 850 acres that are drained by three major discharges. The Hunter Drift drains an underground area of about 400 acres, the Anna S 1 main entry, an area of 330 acres, and Mitchel 2 discharge an area of about 120 acres. As of August 1, 1979, about 55 acres (15%) had been daylighted in the Hunter Drift basin, about 15 acres (5%) in the Anna S main entry basin and about 30 acres (25%) in the Mitchel basin. The acidity of the Mitchel 2 discharge changed the most, from 176 milligrams per liter (as CaCO3) in 1975-76 to 1,190 in 1978-79, an increase of 580%. The acidity of the Hunter Drift discharge increased from 348 milligrams per liter during 1975-76 to 710 milligrams per liter during 1978-79, an increase of 100%. The acidity of Anna S 1 increased about 45%. (USGS)
W81-02447

MICROORGANISMS IN STORMWATER--A SUMMARY OF RECENT INVESTIGATIONS,
Geological Survey, Syosset, NY. Water Resources Div.
G. E. Mallard.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $2.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1198, 1980. 18 p, 3 Fig, 2 Tab, 27 Ref.

Descriptors: *Microorganisms, *Storm water, *Storm runoff, *Coliforms, *Bacteria, Enteric bacteria, Pathogenic bacteria, Urban runoff, Surface waters, Analytical techniques, Water quality, Water pollution sources, Pollutant identification, Coliforms, Fecal-indicator bacteria.

All storm runoff contains a variety of bacteria, including total coliform, fecal coliform, and fecal streptococci, which are derived from the land over which the water flows. Most total coliform are native soil organisms, whereas the fecal coliform and fecal streptococci originate from the feces of wild and domestic animals. Urban runoff has been reported to contain pathogenic organisms, but this probably presents little direct threat to human health because the runoff is not ingested. Runoff water can, however, have other negative effects such as contamination of surface water, which may result in beach closures, or contamination of shellfish. This type of contamination is generally of short duration because indicator bacteria and pathogens die out rapidly in the aquatic environment. Similarly, bacteria and viruses deposited on soil by stormwater are inactivated by drying, competition from soil microflora, and a variety of other processes. Every storm producing runoff is unique in the number and type of microorganisms because these vary from site to site, from storm to storm, and during the course of the storm. Stormwater to be examined for microorganisms must be collected in sterile containers and processed immediately. (USGS)
W81-02478

QUALITY OF URBAN RUNOFF, TECOLOTE CREEK DRAINAGE AREA, SAN DIEGO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. G. Setmire, and W. L. Bradford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-159451, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-70, September, 1980. 33 p, 12 Fig, 10 Tab, 13 Ref.

Descriptors: *Water quality, *Urban runoff, *Storms, *Watersheds(Basins), *California, Water management(Applied), Rainfall-runoff relationships, Discharge(Water), Pollutants, Pesticide residues, Water pollution sources, Chemical oxygen demand, Lead, Nitrogen, Bacteria, San Diego County, Nonpoint pollution sources.

The quality of storm runoff from a 9.2-square-mile urbanized watershed, Tecolote Creek, San Diego County, Calif., was studied during nine storms from September 1976 through May 1977. Specific conductance reached 2,100 micromhos and total residue concentrations reached 2,770 milligrams per liter. The chemical oxygen demand concentration in 95% of the samples exceeded 50 milligrams per liter, a concentration that may be sufficient to cause severe oxygen depletion in areas of the receiving water, Mission Bay. Lead concentrations in all samples exceeded concentrations thought to affect some aquatic organisms. Median total nitrogen and total orthophosphorus concentrations were far in excess of concentrations known to cause nuisance growth of algae in lakes. Fecal coliform bacteria concentrations greatly exceeded recommended levels for primary contact recreation water. Concentrations of pesticides--heptachlor, malathion, chlordane, DDT, diazinon, and dieldrin--frequently exceeded the recommended maximums for marine or freshwater aquatic systems. Total loads of selected constituents are calculated and may be used to estimate the impact of runoff on the receiving water. (USGS)
W81-02480

GROUNDWATER OF COAL DEPOSITS, BAY COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
J. R. Stark, and M. G. McDonald.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $5.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-591, July, 1980. 36 p, 22 Fig, 1 Tab, 13 Ref, Append.

Descriptors: *Coal mines, *Groundwater, *Mine drainage, *Aquifer characteristics, *Michigan, Probability, Model studies, Hydrogeology, Water quality, Chemical analysis, Model studies, Hydraulic conductivity, Storage coefficient, Observation wells, Water levels, Pumping, Drawdown, *Bay County(MI).

A coal deposit in Bay County, Mich., typical of Pennsylvanian-coal deposits in the State, was studied to determine the degree to which hydrologic factors might affect future coal mining. The coal deposit, which averages about 0.5 meters in thickness, lies 50 meters below land surface. It is part of a multi-layered aquifer system that contains sandstone, shale, sand and gravel, and clay units in addition to beds of coal. Hydrologic characteristics (hydraulic conductivity and storage coefficient) of each unit were evaluated by analyses of aquifer tests and a finite-difference groundwater flow model. A model simulating groundwater flow to a hypothetical mine was developed. Results of the study indicate that seepage will probably not be great enough to preclude mining coal. Also, pumping water to keep the mine dry will have little effect on heads in aquifers outside the mine during the first decade of mining. Although coal was mined in Michigan during 1860-1950, significant reserves remain. These deposits, part of the Saginaw Formation of Pennsylvanian age, are near the industrialized parts of the State. The quantity of pumped water needed to keep mines dry and the effect of pumping on aquifers surrounding the mines is a major factor in determining the feasibility of opening new mines. (USGS)
W81-02486

WORK PLAN FOR THE SCHUYLKILL RIVER BASIN, PENNSYLVANIA: ASSESSMENT OF RIVER QUALITY AS RELATED TO THE DISTRIBUTION AND TRANSPORT OF TRACE METALS AND ORGANIC SUBSTANCES,
Geological Survey, Harrisburg, PA. Water Resources Div.
G. L. Pederson, T. H. Yorke, and J. K. Stamer.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price : $3.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-566, October, 1980. 27 p, 1 Fig, 7 Tab, 7 Ref.

Descriptors: *Water quality, *River basins, *Pennsylvania, *Organic compounds, *Trace elements, Metals, Sediment transport, Sediment distribution, Flow characteristics, Water supply, Water utilization, Water analysis, Planning, Water management(Applied), *Schuylkill River(PA).

The U.S. Geological Survey is making a river-quality assessment of the Schuylkill River basin in Pennsylvania from October 1978 to March 1981. The assessment is part of a continuing program designed to demonstrate the effectiveness of river-quality studies for basin planning and water-resource management. Study objectives include determining (1) presence of selected trace metals and organic substances in the water and sediments of the Schuylkill River between Berne and Philadelphia; (2) source, distribution, and transport of selected trace metals and organic substances in the river from Berne to Philadelphia; (3) frequency of occurrence of selected trace metals and organic substances in the river at Pottstown and Manayunk; (4) effects of low-level dams on the distribution and transport of selected trace metals and organic substances in the Schuylkill River between Pottstown and Philadelphia. (USGS)
W81-02488

EFFECT OF PRETREATMENT ON GROUNDWATER CONTAMINATION FROM LEACHING BEDS,
Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
For primary bibliographic entry see Field 5D.
W81-02548

FATE AND TRANSPORT OF DIELDRIN IN CORALVILLE RESERVOIR: RESIDUES IN FISH AND WATER FOLLOWING A PESTICIDE BAN,
Iowa Univ., Iowa City
J. L. Schnoor.
Science, Vol 211, No 4484, p 840-842, February, 1981.

Descriptors: *Dieldrin, *Pesticide residues, *Model studies, *Coralville Reservoir, Iowa River, Path of pollutants, Aldrin, Insecticides, Mathematical models, Water pollution sources, Fish, Sediment, Water analysis, Decision making, Reservoirs, Chlorinated hydrocarbon pesticides, Iowa.

A model of pesticide fate and bioconcentration was developed and applied to the Coralville Reservoir, Iowa. This model was intended to aid in the decision to lift a commercial fishing ban, imposed in 1976 because dieldrin levels in bottom-feeding fish were greater than the Food and Drug Administration guidelines of 0.3 mg per kg wet basis. Use of aldrin and its degradation product, dieldrin, peaked in Iowa in the mid 1960's. The EPA cancelled registration of these pesticides in 1975. Dieldrin residues in water, fish, and sediments have decreased by 15% per year since 1969-1970. The model determined that 40% of the dieldrin entering the reservoir is adsorbed by sediment, 50% is released through the dam gates, and 10% is taken up by fish. Dieldrin degrades at the rate of 0.1% per day in sediment. Projections indicate that residues in fish should average less than 100 micrograms per kg by 1986. (Cassar-FRC)
W81-02571

BIOCONCENTRATION OF LINEAR ALKYLBENZENE SULFONATE (LAS) IN BLUEGILL (LEPOMIS MACROCHIRUS),
Soap and Detergent Association, Wareham, MA.
For primary bibliographic entry see Field 5C.
W81-02576

IDENTIFICATION OF ORGANIC SULFUR COMPOUNDS AND POLYCYCLIC HYDROCARBONS TRANSFERRED TO SHELLFISH FROM PETROLEUM SUSPENSION BY CAPILLARY MASS CHROMATOGRAPHY,
Okayama Univ. Medical School (Japan). Dept. of Public Health.
For primary bibliographic entry see Field 5A.
W81-02578

TECHNIQUE FOR DETERMINING THE VOLATILIZATION COEFFICIENTS OF PRIORITY POLLUTANTS IN STREAMS,
Geological Survey, NSTL Station, MO. Gulf Coast Hydroscience Center.
R. E. Rathbun, and D. Y. Tai.
Water Research, Vol 15, No 2, p 243-250, February, 1981. 3 Fig, 2 Tab, 21 Ref.

Descriptors: *Volatility, *Path of pollutants, *Tracking techniques, Tracers, Radioactivity techniques, Toxins, Aromatic compounds, Organic wastes, Natural streams, Laboratory tests, Gas chromatography.

Of the 129 EPA priority pollutants, 31 are purgeable organics. Knowledge of the volatility of these compounds in natural waters will aid in studying their fate as pollutants of rivers and streams. Laboratory tests were conducted to determine the volatilization coefficients of benzene, chloroform, methylene chloride and toluene concurrently with the measurement of the oxygen absorption coefficient over a range of mixing conditions. A tracer technique was used which was based on the mathematical relationship between the liquid-film coefficients for a tracer material (rhodamine WT dye) and for the organic solute (ethylene or propane) volatilizing from the same water. When the constancy of the ratios between the organic solute and oxygen coefficients is applied to the modified tracer technique for the measurement of stream reaeration coefficients, the volatilization coefficients of these solutes may be calculated for any stream or river without direct introduction of the compounds into the natural waters. The calculated volatilization coefficients for these solutes in a number of streams and rivers of the United States are presented. (Geiger-FRC)
W81-02583

THE FATE OF SEWAGE PHOSPHORUS INPUT TO A SUBARCTIC LAKE CHAIN,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
J. J. Drake, and I. J. Freund.
Water, Air, and Soil Pollution, Vol 14, p 331-337, 1980. 4 Fig, 7 Ref.

Descriptors: *Lakes, *Phosphorus compounds, *Sewage disposal, *Nutrients, Phosphates, Eutrophication, Subarctic, Pearce Lake, Canada, Dissolved oxygen, Iron compounds, Sedimentation, Water pollution effects, *Path of pollutants, *Quebec.

Pearce Lake, Quebec, receives the sewage from the iron mining town of Schefferville, population 4500. This paper describes the fate of phosphorus in this subarctic lake and 2 other connected lakes during the year. In winter the lake is ice covered. Sewage accounts for 35% of the total inflow. Water residence time is 60 days, phosphorus concentration is as high as 1.0 mg per liter. and dissolved oxygen is very low (less than 1 mg per liter in bottom waters. During the spring melt, residence time is 2 days and total phosphorus concentration drops to less than 0.1 mg per liter, remaining at this level during summer and fall. Iron-rich groundwater promotes sedimentation of phosphorus in Pearce Lake, mostly during the spring melt. About 80% of the phosphorus remains sedimented in Pearce Lake. The top 25 cm of sediment con

tains significantly more phosphorus than deeper sediments. Although water from Pearce Lake flows into LaCosa Lake and June Lake, only 12% of the phosphorus load leaves the 3-lake system. Although the subarctic is generally considered a sensitive environment, in this case Fe-rich anoxic groundwater and extremely rapid spring flushing allows sewage disposal with surprisingly little environmental impact. (Cassar-FRC)
W81-02593

HAZARDOUS WASTE MANAGEMENT: STATE BY STATE.
Water Well Journal, Vol 34, No 11, p 55-57, November, 1980. 1 Tab, N. Thompson, compiler.

Descriptors: *Legislation, *Waste disposal, *Water pollution sources, Water law, Well regulations, Water wells, Test wells, State governments, *Hazardous materials.

A table lists hazardous waste legislation and the office in charge of hazardous waste management for each state. At present 36 states and the District of Columbia have laws regulating hazardous waste; 14 do not. States without such legislation are Alaska, Arizona, Colorado, Florida, Hawaii, Idaho, Indiana, Nebraska, Pennsylvania, South Dakota, Tennessee, Virginia, West Virginia, and Wyoming. This compilation is directed toward water well drillers working with groundwater monitoring programs for hazardous waste disposal facilities. (Cassar-FRC)
W81-02597

THE IMPORTANCE OF GROUNDWATER MONITORING,
D. Nielsen.
Water Well Journal, Vol 34, No 11, p 38-39, November, 1980.

Descriptors: *Groundwater, *Water quality, *Monitoring, Resource Conservation and Recovery Act, Water pollution sources, Waste dumps, Pollutant identification, Legislation, Regulation, Analytical techniques, Test wells.

Although groundwater is the source of drinking water for 110 million people in the U.S., it remains relatively unprotected from contamination from landfills, industrial wastes, mining and oil well drilling operations, waste water effluents, septic tanks, and farm wastes. The Resource Conservation and Recovery Act (RCRA) requires state agencies to inventory groundwater pollution sources and design and implement programs for monitoring. At hazardous waste disposal sites, 4 monitoring wells are required. A groundwater monitoring program must inventory background water quality, determine and analyze causes of water quality variations, and predict future water quality changes. Problems in implementing a successful monitoring program are interpretation of legal requirements and data, selection of sample frequency and parameters, and construction of equipment. Help in solving these problems is not easily available because there is not yet much agreement on the best methods to use. In addition, groundwater monitoring technology is not as advanced as surface water monitoring technology. Solutions to these problems must be found if groundwater monitoring is to be smoothly implemented. (Cassar-FRC)
W81-02598

SYNTHETIC ORGANIC COMPOUNDS IN GROUNDWATER,
T. Gass.
Water Well Journal, Vol 34, No 12, p 28-29, December, 1980. 1 Tab.

Descriptors: *Organic compounds, *Chemical wastes, *Potable water, *Groundwater, Industrial wastes, Waste disposal, Water quality, Landfills, Aquifers, Water pollution sources, Water wells, Wells.

A federal monitoring program showed that 60% of 39 groundwater supplies tested contained 1 or more synthetic organic chemicals. Frequencies of chemicals found in raw groundwater were as follows: trichloroethylene, 33%; carbon tetrachloride, 7%; tetrachloroethylene, 18%; methylene chloride, 2%; and vinyl chloride, 16%. All of these chemicals are used industrially, and many are suspected of causing cancer, birth defects, and other health effects in small concentrations. Examples are given of 2 cases where community water wells were contaminated with waste oil or chemical wastes. (Cassar-FRC)
W81-02599

TO WHAT EXTENT IS GROUND WATER CONTAMINATED,
T. E. Gass.
Water Well Journal, Vol 34, No 11, p 26-27, November, 1980. 2 Tab.

Descriptors: *Groundwater, *Aquifers, *Water pollution sources, *Water quality, Waste dumps, Landfills, Mining, Soil disposal fields, Septic tanks, Municipal wastes.

A model has been developed to estimate the extent of groundwater contamination based on number of sites, permeability of soil, location of nearby aquifers, characteristics of the waste, and disposal site design and operating procedures. Of 25,000 active industrial waste impoundments, about 8,400 pose a hazard to usable aquifers. If each site contaminates 60 acres, the total area contaminated would be 790 sq miles. About 14,000 to 90,000 landfills are located in areas with rainfall, soil, and aquifer conditions conducive to pollution. Assuming a 60 acre per site contamination area it is calculated that 1,300 to 8,400 sq miles may be affected. Subsurface disposal systems may affect about 50,000 sq miles, and petroleum and mining activities another 5,000 sq miles. These figures indicate that 1.2 to 1.5% of the total usable aquifer area in the United States may presently be polluted. (Cassar-FRC)
W81-02601

MICROBIOLOGY OF GROUNDWATER,
Environmental Protection Agency, Dallas, TX.
M. J. Allen.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1804-1807, June, 1980. 30 Ref.

Descriptors: *Microbiology, *Groundwater, *Reviews, Path of pollutants, Bibliographies, Bacteria, Microorganisms, Water pollution sources, Coliforms.

A review of the 1979 literature on groundwater microbiology includes a variety of studies. Statistics are given on waterborne disease associated with contaminated groundwater. The effect of rainfall patterns on microbiological quality of groundwater supplies is described. A case of Salmonella pollution in the absence of coliform pollution is attributed to lizards in the wells. Petroleum in groundwater is slow to degrade because dissolved oxygen, organic nitrogen, and phosphorus are limited. A study on viruses indicated that a soil pH of 5 or lower resulted in good absorption of viruses. With respect to bioindicators, antibiotic-resistant E. coli proved more suitable as a tracer in monitoring soil water movement than fluorescent dyes. Several studies were done on movement of microorganisms through the soil after application of domestic or farm wastes. Bacteriological aspects of oil and gas drilling were discussed. Methanotrophic bacteria were found associated with oil and gas well water. Bacteriological consequences of using carbohydrate polymers in drilling fluids were discussed. (Cassar-FRC)
W81-02607

SOURCES OF SOLUBLE ORGANIC NITROGEN IN ACTIVATED SLUDGE EFFLUENTS,
Stanford Univ., CA. Dept. of Environmental Engineering.
G. F. Parkin, and P. L. McCarty.
Journal of the Water Pollution Control Federation, Vol 53, No 1, p 89-98, January, 1981. 8 Fig, 4 Tab, 15 Ref.

Descriptors: *Nitrogen compounds, *Activated sludge, *Organic compounds, *Effluents, Waste water treatment, Biodegradation, Chemical oxygen demand, Suspended solids, Aeration, Path of pollutants, Water pollution sources.

Sources of soluble organic nitrogen (SON) in activated sludge effluents were determined. Minimum SON concentrations resulted from operation of conventional activated sludge plants with solids retention times of 6-10 days. 60-70% SON and 70-80% soluble COD were removed. About 20-40% of the SON in the effluent was produced biologically during the process, and the remainder from residual organics in the influent. The biologically-produced SON came from 3 sources: equilibration with the activated sludge organisms (independent of organism concentration and temperature and dependent on culture characteristics--20-50% of the total), organism decay (a function of mixed liquor suspended solids concentration and of the solids retention time--20-50% of the total), and substrate oxidation (small compared with the others). (Cassar-FRC)
W81-02617

PRODUCTION OF SOLUBLE ORGANIC NITROGEN DURING ACTIVATED SLUDGE TREATMENT,
Stanford Univ., CA. Dept. of Environmental Engineering.
G. F. Parkin, and P. L. McCarty.
Journal of the Water Pollution Control Federation, Vol 53, No 1, p 99-112, January, 1981. 16 Fig, 6 Tab, 29 Ref.

Descriptors: *Nitrogen compounds, *Activated sludge, *Organic compounds, *Effluents, Waste water treatment, Biodegradation, Chemical oxygen demand, Suspended solids, Aeration, Path of pollutants, Water pollution sources.

The concentration of soluble organic nitrogen (SON) in the activated sludge process was variable and related to uncontrollable cultural factors. During activated sludge startup, effluent SON increased by several mg per liter as a result of biological production of SON. Results of this study confirmed conclusions presented in a previous report. (Cassar-FRC)
W81-02618

THE POTENTIAL FOR GROUNDWATER CONTAMINATION FROM SEPTIC EFFLUENTS,
Mississippi State Univ., Mississippi State. Dept. of Agronomy.
C. Hagedorn, E. L. McCoy, and T. M. Rahe.
Journal of Environmental Quality, Vol 10, No 1, p 1-8, January/March, 1981. 1 Tab, 60 Ref.

Descriptors: *Path of pollutants, *Septic tanks, *Reviews, Domestic wastes, *Groundwater pollution, Coliform bacteria, Pathogens, Water pollution sources, Viruses, Soil disposal fields, Recharge, Groundwater, Environmental sanitation, Waste water disposal, Percolation.

There is increasing evidence that the pollution of groundwater in many cases may be traced to faulty septic tank systems that use soil percolation and microbial activity to remove pathogens and wastes from domestic effluents. A review is presented on the contamination of recharge waters in both rural and urban areas of the United States due to incompletely treated septic wastes. The conditions that prevail during septic system malfunctions and the means by which fecal pathogens come into contact with various water resources are examined. The functions of drainfield systems and results from microbiological studies on the conditions required for the effective removal of enteric organisms from domestic effluents are discussed. Bacterial transport through soils and the removal of viruses from waste effluents are considered. The need for improved septic tank systems is stressed, with suggestions for determining the suitability of septic tank systems in relation to regional soil-water conditions. (Geiger-FRC)
W81-02628

THE OIL SPILL AGE--FATE AND EFFECTS OF OIL IN THE MARINE ENVIRONMENT,
Centre National pour l'Exploitation des Oceans, Paris (France).
P. Nounou.
Ambio, Vol 9, No 6, p 297-302, 1980. 31 Ref.

Descriptors: *Oil spills, *Water pollution effects, *Path of pollutants, Environmental effects, Ecology, Toxicity, Oil pollution, Marine animals, Marine plants, Aquatic life, Biodegradation, Degradation, Ships, Sediments, Persistence, Water pollution sources.

This paper presents a summary of the fate and effects of oil pollution in the marine environment and prospects for the future. Although large spills from wrecked ships or blown wells are more spectacular, 90% of oil in the ocean comes from rivers, coastal refineries, deballasting by tankers, offshore exploration, and natural seepage. Within a few days after a discharge, oil spreads on the surface, the volatile components evaporate, and the oil disperses according to properties of the oil and the energy in the environment. Emulsification and tar lump formation can occur. Oil may then degrade chemically or biologically or persist in sediment. Literature on effects of petroleum on marine organisms is not very consistent because researchers use different techniques and different oils. Lethal concentrations vary with species and age of the organism, eggs being very sensitive. Sublethal effects are many. Direct coating and ingestion of oil affect immobile species, such as barnacles and algae, as well as sea birds. Edible fish and shellfish can be contaminated. Bioaccumulation of carcinogens in food chains is widespread, as are disturbances in ecosystems. The greatest damage occurs near the shore, but deep-sea contamination of breeding grounds or migration routes can severely damage some species. (Cassar-FRC)
W81-02645

5C. Effects Of Pollution

RESPONSES OF COPEPOD INDIVIDUALS AND POPULATIONS TO INCREASED TEMPERATURE VARIABILITY,
Maryland Univ., Baltimore County, Baltimore. Dept. of Biological Sciences.
B. P. Bradley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185266, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, 1980. University of Maryland, College Park, Water Resources Research Center Technical Report No 62. 25 p, 1 Fig, 16 Tab, 6 Ref. OWRT-A-053-MD(1), 14-34-0001-0122.

Descriptors: *Copepods, On-site investigations, *Thermal pollution, *Powerplants, Water pollution sources, *Water pollution effects, Aquatic animals, *Aquatic life, Crustaceans, On-site data collections, Water pollution, Heated water, Electric power plants, Industrial plants, Pollutant identification, Pollutants, Temperature, Warm temperature, Water quality, Mortality, Stress analysis.

Emphasis in this study was placed on field studies of populations of two species of copepods, Eurytemora affinis (EA) and Acartia tonsa (AT), in the vicinity of two power plants. These species are seasonally dominant; EA in winter and spring, AT in summer and fall. The study sought to identify the effects of waste heat on local population densities and survival. Results include temperature variation measurements around the power plants, observed temperature tolerances and species population densities, limited laboratory studies on reproduction following shock, and preliminary estimates of potentials for adaptation. Variability in density and temperature tolerances of EA and AT were associated with temperature variability caused by power-generating plant waste heat. At least part of the diversity between stations in EA tolerance of temperature was genetic. Greatest stress seemed to occur at a station having low circulation of heated water, suggesting that chronic long-term heat stress may be more harmful than acute short-term heat stress. Data on reproduction suggested entrainment followed by discharge into rapidly cooled waters would have less impact than chronic exposure at a lower temperature. (Zielinski-IPA)
W81-02406

LABORATORY SIMULATION OF ACID RAIN EFFECTS ON FRESHWATER MICROCRUSTACEANS,
Maryland Univ., College Park. Dept. of Zoology.
J. D. Allan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185225, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, 1980. University of Maryland Water Resources Research Center Technical Report No 60. 5 p, 1 Fig, 1 Tab, 4 Ref. OWRT-A-054-MD(1), 14-34-0001-9022.

Descriptors: *Acidic rain, *Hydrogen ion concentration, Precipitation(Atmospheric), *Water pollution effects, Laboratory tests, *Toxicity, *Daphnia, Chemical properties, Water properties, Neutralization, Water pollution sources, Water pollution, Water quality, Acid streams, Bioassay, Aquatic animals, Aquatic life, Crustaceans, Research and development, Assay.

The principal objective of this study was to investigate the sensitivity of freshwater microcrustaceans to stress associated with acid rain. All experiments were performed in large (50-gallon) aquaria in order to have satisfactory pH control, to be able to use sufficient numbers of replicates for each pH treatment, and to be sufficient to make small additions of sulfuric acid since the test water had low alkalinity. The potential effect of acid rain on Daphnia pulex (Crustacea: Cladocera) was studied in laboratory populations subjected to exposures for 1, 12, 24, 48, and 96 hours at pH levels ranging from 4.0 to ambient (6.6). After the exposure duration, daphnids were transferred to control water and observed after 3, 6, 12, 24 hours, and every 24 hours thereafter up to ten days. The experimental design was such that the interaction of dosage and exposure time could be separated. Daphnia pulex appeared to be severely affected by pH of 4-4.5. The study resulted in the development of a satisfactory test system for examining acid stress in laboratory populations of freshwater crustaceans. (Zielinski-IPA)
W81-02407

SUBLETHAL EFFECTS OF POLLUTANTS: LIFE TABLE EVALUATION OF CHRONIC EXPOSURE OF EURYTEMORA AFFINIS (COPEPODA) TO KEPONE,
Maryland Univ., College Park. Dept. of Zoology.
J. D. Allan, and R. E. Daniels.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185209, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, November, 1980. University of Maryland Water Resources Research Center Technical Report No 61. 16 p, 5 Fig, 2 Tab, 27 Ref. OWRT-B-035-MD(1), 14-34-0001-0265.

Descriptors: *Pesticide toxicity, *Organic pesticides, *Fishkill, *Copepods, Growth rates, Bioassay, Water analysis, Water pollution sources, Pesticides, Chlorinated hydrocarbon pesticides, Agricultural chemicals, Chemicals, Balance of nature, Toxicity, Pesticide residues, Public health, Aquatic animals, Aquatic life, Period of growth, Assay, Laboratory tests.

It is generally recognized that chronic exposure to toxins may be deleterious at concentrations well below those identified as lethal in short-term, acute toxicity tests. Previously the authors had hypothesized that the intrinsic rate of natural increase (r), calculated from the life table equation, is an ecologically-meaningful bioassay and a useful protocol for toxicity tests. The r statistic is based on survivorship and fecundity, and is a measure of a population's capacity to increase in an unlimited environment. In the present study, life table estimates of r were used to assess effects of chronic exposure of the estuarine copepod Eurytemora affinis to Kepone. Acute toxicity was determined to be 40 micrograms/liter (mcg/l). A reduction in r was observed in all Kepone concentrations above 5 mcg/l, and r was near zero at 20 mcg/l. This was due to the combination of lowered survivorship, delayed onset of reproduction, and reduced fecundity. The value of the life table approach was discussed both as an experimental protocol and an ecologically realistic bioassay of chronic effects. As little as 21 days is an adequate test period. (Zielinski-IPA)
W81-02408

EFFECTS OF SALINITY STRATIFICATION AND ADVERSE WATER QUALITY ON THE BENTHIC INVERTEBRATE COMMUNITY OF SOUTHERN LAKE PONTCHARTRAIN, LOUISIANA,
New Orleans Univ., LA. Dept. of Biological Sciences.
J. A. Junot.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185290, Price codes: A05 in paper copy, A01 in microfiche. Master of Science Thesis, August, 1979. 73 p, 8 Fig, 10 Tab, 67 Ref. OWRT-A-045-LA(3).

Descriptors: *Salinity currents, Impaired water quality, *Benthic fauna, *Louisiana, *Aquatic populations, *Stratification, Salinity, Water currents, Density currents, Chemical properties, Water quality, Water pollution effects, Aquatic animals, Benthos, Fauna, Benthic environment, Environment, Ocean bottom, Annelids, Aquatic life, Chemical stratification, *Lake Pontchartrain.

The benthos of southern Lake Pontchartrain in Louisiana was studied from July 1976 to July 1978, with seasonal sampling of seven off-shore stations and of three stations in the New Orleans Marina complex. The offshore stations were located along a west-to-east transect from the Lake causeway to the Inner Harbor Navigation Canal, following a gradient of increasing salinity stratification and decreasing bottom dissolved-oxygen values. Faunal differences between the stations were examined, using indices of diversity, biological dominance, pollution, and station homogeneity. Fauna of the Marina stations had low species diversity, and were dominated by annelids, indicating an area of poor water quality. Fauna of stations near the Navigation Canal were similar to the Marina stations. Stations to the west of the Canal showed an increased species diversity, and the fauna were dominated by molluscs. The observed faunal differences along the east-to-west transect appeared to be due to poor bottom water quality as a result of the salinity stratification. (Zielinski-IPA)
W81-02417

PHYSICAL ENVIRONMENT AND HYDROLOGIC CHARACTERISTICS OF COAL-MINING AREAS IN MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
J. E. Vaill, and J. H. Barks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-126765, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-67, 1980. 33 p, 12 Fig, 2 Tab, 48 Ref.

Descriptors: *Environmental effects, *Coal mines, *Water quality, *Hydrogeology, *Missouri, Acid mine water, Mine drainage, Groundwater, Surface waters, Water pollution effects, Groundwater movement, Water analysis.

Hydrologic information for the north-central and western coal-mining regions of Missouri is needed to define the hydrologic system in these areas of major historic and planned coal development. This report describes the physical setting, climate, coal-mining practices, general hydrologic system, and the current (1980) hydrologic data base in these two coal-mining regions. Streamflow in both mining regions is poorly sustained. Stream water quality generally varies with location and the magnitude of coal-mining activity in a watershed. Streams in non coal-mining areas generally have dissolved-solids concentrations less than 400 milligrams per liter. Acid-mine drainage has seriously affected some streams by reducing the pH to less than 4.0 and increasing the dissolved-solids concentrations to greater than 1,000 milligrams per

liter. This has resulted in fish kills in some instances. Groundwater movement is impeded both laterally and vertically in both mining regions, especially in western Missouri, because of the low hydraulic conductivity of the rocks of Pennsylvanian age. The quality of groundwater varies widely depending on location and depth. Groundwater commonly contains high concentrations of iron and sulfate, and dissolved-solids concentrations generally are greater than 1,000 milligrams per liter. (USGS)
W81-02448

ARE PUBLIC AND RECREATIONAL WATER SUPPLIES IN MONTANA SAFE FROM YERSINIA ENTEROCOLITICA GASTROENTERITIS,
Montana Univ., Missoula. Dept. of Microbiology.
For primary bibliographic entry see Field 5A.
W81-02492

SALT MARSH CREATION: IMPACT OF HEAVY METALS,
Skidaway Inst. of Oceanography, Savannah, GA.
W. S. Gardner.
In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, Georgia, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC. Report FWS/OBS-80/27 November, 1980, p 126-131. 2 Fig, 11 Ref.

Descriptors: *Heavy metals, *Salt marshes, *Marsh management, *Water pollution, Estuarine environment, Coasts, Dredging, Sediments, Water chemistry, Mercury, Mercury compounds, Food chains, Marsh plants.

The impact of heavy metals on marshes depends on the composition, distribution, availability, and biological effects of the metals in the sediments and water at the site. Estuaries can often be considered as funnels for the transport of pollutants to the sea, but some parts of the estuarine system, such as salt marshes, may also act as filters for pollutants. In addition to continental input through rivers, metals can be introduced into coastal regions by local sources of pollution, including industrial effluents and dredging. The total concentration of a heavy metal in an estuary or marsh may not determine its availability or toxicity to organisms. Occluded minerals may not be biologically available, while metals dissolved in the water or loosely sorbed to particles are directly available. If a system is in equilibrium, thermodynamic processes determine the distribution of the metal in the solid, liquid, or gaseous phases. Equally important in most natural systems are kinetic processes which control the physical, chemical, and biological distribution in the marsh estuarine system. During dredging, operations, normally reduced sediments are exposed to oxygen and a series of reactions affecting heavy metal concentrations can occur. Plants may affect movement of metals by removing them from solution or transferring them from one compartment to another. Studies suggest that metals are not taken up and retained by plants in the marsh to the extent that they occur in the sediments; however, mercury may be an exception. Methyl mercury is of particular interest because: it is highly toxic to higher organisms, it can be formed from other forms of mercury in the sediments, and it tends to be concentrated by food chain amplification. (Moore-SRC)
W81-02538

MARSH CREATION: IMPACT OF PESTICIDES ON THE FAUNA, USE OF INFRARED PHOTOGRAPHY, DITCHING AND DIKING,
Georgia Dept. of Natural Resources, Brunswick, Coastal Resources Div.
R. J. Reimold.
In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, Georgia, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC., Report FWS/OBS-80/27, November, 1980, p 132-135. 2 Ref.

Descriptors: *Marsh management, *Pesticides, *Water pollution, *Aquatic animals, Coasts, Wetlands, Estuarine environment, *Georgia, Species diversity, Infrared imagery, Aerial photography, Drainage ditches, Toxaphene.

Species diversity is used as an indication of the effects of toxaphene on the fauna of two estuarine systems. Brunswick Estuary in Georgia receives toxaphene from a manufacturing plant and from agricultural runoff. The Duplin Estuary is a pristine estuary, part of a National Estuarine Sanctuary. The study covers the period 1968-1976. Except for the early years of the study (1968-1971), no measurable quantities of toxaphene were found anywhere except very close to the manufacturing plant. Since the study began, the levels of toxaphene in the manufacturing plant effluent decreased from parts per hundred to parts per billion. There was a dramatic change both in the number of species and in the number of individuals over the years. The diversity indices for Terry Creek, the stream into which the toxaphene effluent was discharged, revealed that in 1968 there were only three different kinds of organisms, as opposed to nearly 25 species by 1976. Biomass also increased with time. After the first three years, the number of species remain more constant in the Brunswick Estuary than it did in the natural Duplin Estuary. Color infrared aerial photography is useful for ecological delineation and for economic delineation including legal purposes. Ditching and diking for habitat creation and mosquito control have a variety of effects on marshes. Ditching reduces the water level, can cause invasion of upland species, and reduces the area of vegetated wetland. Another problem with ditching is the creation of cat clays. The various consequences of alteration of the salt marsh ecosystem should be evaluated when ditching or diking is being considered. (Moore-SRC)
W81-02539

MARSH CREATION: EFFECTS OF PESTICIDES ON THE FLORA,
Delaware Univ., Lewes. Coll. of Marine Studies.
J. L. Gallagher.
In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, Georgia, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC., Report FWS/OBS-80/27, November, 1980, p 136-139. 11 Ref.

Descriptors: *Marsh management, *Pesticides, *Marsh plants, Coasts, Wetlands, Ecosystems, Fungicides, Herbicides, Insecticides, Food chains, Pest control, Pesticide residues, Environmental effects, Ecosystems.

Marsh managers must contend with two kinds of situations at the ecosystem level with respect to pesticides. In the first situation, the marsh is the target for pesticide application, and in the second, the wetland ecosystem is the recipient of an accidental spill. At the ecosystem level there is a two by two matrix of situations to consider: target or nontarget exposure, and direct or indirect effects. It appears that there is a trend toward an agricultural type of management of coastal ecosystems, which may be a prelude to the kinds of insect and disease situations experienced in agriculture. This may lead to an increased use of insecticides, herbicides and fungicides where the marsh is the target ecosystem. The examination of a few actual cases of pesticide-marsh flora interactions and several hypothetical cases points out the complexities of the problem of pesticides in the wetlands. Basic knowledge of wetland processes will aid in theorizing the fate and trophic transfer in the food chain. Once these are identified, they must be tested with various pesticides. If it is determined that potentially serious problems exist in situations where wetlands are the target ecosystems, they can be avoided by changing the management practice. The uncontrolled situation is that where the wetland is a nontarget ecosystem. Methods of ameliorating such interaction should receive research priority. (Moore-SRC)
W81-02540

NUTRIENT CYCLING IN COASTAL ECOSYSTEMS,
Georgia Univ., Athens. Inst. of Ecology.
L. R. Pomeroy.
In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, Georgia, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC., Report FWS/OBS-80/27, November, 1980, p 140-147. 3 Fig, 16 Ref.

Descriptors: *Coasts, *Cycling nutrients, *Estuarine environment, Food webs, Productivity, *Ecosystems, Eutrophication, Salt marshes, Aquatic plants, Nitrogen, Phosphorus, Carbon, Sulfur, Water pollution, Bacteria.

Most estuarine situations or other coastal areas, especially those with macroscopic plants, are regions of high primary productivity. That leads into the question of nutrient supply, because to maintain high productivity, plant nutrients must be sufficient. The high productivity of coastal systems in many cases depends heavily on recycling of phosphorus, rather than on a continued supply of new phosphorus into the system. The major role of bacteria in the phosphorus cycle may be scavenging phosphorus, and turnover time of bacteria is probably a matter of one day in most systems. The result is that phosphate moves through both phytoplankton and the bacteria to filter-feeding consumers and benthic deposit feeding consumers. By the time food has gone through the first level of carnivores, 90% or more of the phosphate has been excreted. There is an inflow of phosphorus from rivers to coastal waters, and phosphorus from rivers to coastal waters, and phosphorus also comes from the ocean, so that phosphorus is not an element that is limiting in coastal zone water. One of the biggest differences in nitrogen cycles is that the main reservoir of nitrogen is the atmosphere. Carbon is rarely a limiting element in the coastal zone. The coastal highly productive zones are probably regions of relatively high input of sulfur to the atmosphere. Elements such as nitrogen and phosphorus are key elements in aquatic coastal systems both as limiting factors and as causes of eutrophication. (Moore-SRC)
W81-02541

SALT MARSH CREATION: IMPACT OF SEWAGE,
Georgia Univ., Sapelo Island. Marine Inst.
E. Haines.
In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, Georgia, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC., Report FWS/OBS-80/27, November, 1980, p 148-153. 2 Fig, 17 Ref.

Descriptors: *Salt marshes, *Sewage sludge, *Water pollution effects, *Marsh plants, Wetlands, Coast, Fertilizers, Water quality, Estuarine environment, Algae, Waste disposal, Productivity, Nitrogen, Phosphorus, Nutrients.

Increasing amounts of sewage are being deposited in coastal wetlands. A lot of the sewage has not even had primary treatment, and the increasing biological oxygen demand in coastal wetlands has already resulted in marked deterioration of water quality in some estuaries. The impact of applying sewage sludge on the nitrogen cycle in marshes was evaluated in two separate studies, one in Massachusetts, and one in Georgia. Sewage fertilization increases the plant biomass, but does not stimulate belowground growth, and may decrease root growth in salt marshes. Addition of sewage fertilizer may decrease the rate of nitrogen fixation, and increase denitrification. The rate of benthic algal production was actually decreased in Massachusetts, as a result of the increased standing plant biomass shading the algae. Marsh plants and benthic algae have high rates of production and can assimilate some nutrients. The clay soils in Georgia estuaries can accumulate a lot of phosphate. The marsh is a fairly stable community and appears to be quite resilient, at least to enrichment stresses. In some respects the salt marsh is a good tertiary treatment facility. (Moore-SRC)
W81-02542

EFFECT OF SEWAGE AND INDUSTRIAL WASTES ON THE FLORISTIC COMPOSITION AND DISTRIBUTION OF MACROPHYTIC VEGETATION IN THE RIVER KHAN,
Vikram Univ., Ujjain (India). School of Studies in Botany
S. V. R. Rao, and L. P. Mall.
Water Research, Vol 15, No 2, p 287-288, February, 1981. 2 Tab, 2 Ref.

Descriptors: *Rivers, *Macrophytes, *Sewage effluents, Plant populations, Biomass, Environmental effects, Industrial wastes, Water pollution effects, Seasonal, Aquatic plants, *India, Discharge, Khan River.

The effects of industrial wastes and sewage on the tropical river Khan originating near Indore, India were examined at 9 sampling stations downstream from the waste discharge site. Increased macrophyte species occurred at stations 2 and 3, about 10 kilometers downstream of the discharge site, with returns to normal floristic composition at the remaining sampling stations. The winter and summer mean biomass values of the macrophytic vegetation were also greatest at the third sampling station, with Vallisneria spiralis, Polygonum glabrum and Potomogeton pectinatus providing most of the biomass. Results of these vegetation studies on the river Khan were similar to those reported for the effects of waste water discharge on the New River of Virginia, which reported decreases in the number of species by over one half at the site of effluent discharge and drastic reductions in the biomass of the major vegetational components at the points of the major effluent discharges. These findings indicate that the discharge of sewage and industrial wastes has a deleterious effect on the floristic composition and biomass of the macrophytic vegetation in the river Khan. (Geiger-FRC)
W81-02574

BIOCONCENTRATION OF LINEAR ALKYLBENZENE SULFONATE (LAS) IN BLUEGILL (LEPOMIS MACROCHIRUS),
Soap and Detergent Association, Wareham, MA.
R. A. Kimerle, K. J. Macek, B. H. Sleight, III, and M. E. Burrows.
Water Research, Vol 15, No 2, p 251-256, February, 1981. 3 Fig, 3 Tab, 14 Ref.

Descriptors: *Sunfishes, *Absorption, *Alkylbenzene sulfonates, Biodegradation, Metabolism, Surfactants, Water pollution, Domestic wastes, Kinetics, Pollutants, Public health, Toxicity, Fish toxins, Laboratory tests, Water pollution sources, Detergents, Fish, *Bluegills.

As a component of many household laundry detergents, linear alkylbenzene sulfonate (LAS) is a common constituent of domestic waste waters and has the potential of reaching surface waters. Although the anionic surfactant is readily degraded to carbon dioxide and water by bacteria, it is necessary to examine bioconcentration of the compound in edible aquatic species to determine any possible adverse health effects to man. Bluegill, Lepomis macrochirus, were exposed for 35 days to a mean C14-LAS concentration of 0.5 milligrams/liter, followed by 14 days of depuration. The steady state whole body bioconcentration factor (BCF) was estimated as 104 when all radioactivity was assumed to be intact LAS. Muscle BCF was 36 and gall bladder BCF was 5000. BCF's for liver, gills, viscera, blood and the remaining carcass ranged from 64 to 283. Rapid clearance of C14 activity from all organs and tissues was observed with half-lives of 2-5 days. Results were in agreement with other LAS studies in the literature and suggested metabolism of the surfactant to simpler products. On the basis of these experiments it was concluded that LAS posed no threat as a fish contaminant at the levels found in surface waters. (Geiger-FRC)
W81-02576

AN APPROACH FOR THE EVALUATION OF EFFICACY OF WETLANDS-BASED PHOSPHORUS CONTROL PROGRAMS FOR EUTROPHICATION-RELATED WATER QUALITY IMPROVEMENT IN DOWNSTREAM WATERBODIES,
Colorado State Univ., Fort Collins. Environmental Engineering Program.
R. A. Jones, and G. F. Lee.
Water, Air, and Soil Pollution, Vol 14, p 359-378, 1980. 5 Fig, 5 Tab, 25 Ref.

Descriptors: *Eutrophication, *Phosphorus compounds, *Nitrogen compounds, Nutrients, *Lake Okeechobee, Florida, Lakes, *Wetlands, Phosphates, Algae, Water quality, Shallow water, Aquatic plants.

A study of available information on eutrophication of Lake Okeechobee indicated that the proposed re-creation of marshes and wetlands may have little positive impact on the water quality of the lake. Present data on nutrients in the system show a confused picture, and further studies are needed on amounts and available forms of N and P during the summer growing season. The role of color as a factor in limiting algal growth should be determined. If it is significant, then control of phosphorus loading through wetlands restoration would have little effect on the lake's water quality. The long hydraulic residence time (1 year) permits nutrients released from the wetlands to accumulate in the lake, producing a net P balance unless aquatic plants are harvested. The Vollenweider Organization for Economic Cooperation and Development model appears to be useful for predicting the planktonic algal chlorophyll response to P loading in Lake Okeechobee. Based on limited data, a 50% total P load reduction to the lake would result in a decrease from 31 to 22 micrograms per liter of chlorophyll, a noticeable improvement in water quality; a 10% decrease, an undetectable change. (Cassar-FRC)
W81-02595

DECISION PROBLEMS IN THE CONTROL OF ACID PRECIPITATION: NONCONVEXITIES AND IRREVERSIBILITIES,
Wyoming Univ., Laramie. Dept. of Economics.
T. D. Crocker, and B. A. Forster.
Journal of the Air Pollution Control Association, Vol 31, No 1, p 31-37, January, 1981. 5 Fig, 2 Tab, 34 Ref.

Descriptors: *Cost-benefit analysis, *Aquatic habitats, *Acidic water, *Acid rain, Decision making, Benefits, Economics, Fish, Aquatic animals, Precipitation(Atmospheric), Curves, Mathematical studies, Graphical analysis, Water pollution control, Air pollution, Hydrogen ion concentration, Environmental effects, Ecology.

The nonconvexities and irreversibilities in the dose-response functions for the ecological effects of acid precipitation must be considered in evaluating cost vs. benefits of controlling acid gases from fossil fuel combustion. When decisions are based on current market prices alone, the economic damage to an ecosystem may be underestimated. The presently used compromise control measures, where a certain level of environmental harm is allowed to obtain benefits of moderately increased fossil fuel combustion, may be an undesirable policy. This system suggests that there are some aquatic systems which are irreversibly acid. Corrective costs would greatly exceed potential benefits. This situation can be prevented by collecting sufficient information before beginning or continuing any acid producing activity. Systems on the verge of acidification should receive first consideration. (Cassar-FRC)
W81-02637

MICROBIOLOGICAL PARAMETERS FOR DIFFERENTIATING BETWEEN COASTAL AND OPEN WATERS IN THE NORTHERN BALTIC PROPER AND THE GULF OF FINLAND,
Zoological Station, Tvarminne.
P. Vaatanen.
Journal of Applied Bacteriology, Vol 49, No 3, p 455-462, December, 1980. 2 Fig, 6 Tab, 13 Ref.

Descriptors: *Marine bacteria, *Bioindicators, Aquatic microbiology, Water pollution effects, Environmental effects, *Baltic Sea, Aquatic environment, Littoral, Aquatic populations, Sediments, Oceans, Sea water, Yeasts.

Microbial populations from three sites in the Tvarminne archipelago of the Baltic Sea, two inshore and a third (Ajax) offshore, were compared with populations from four sites representing the offshore areas of the northern Baltic proper and the entrance to the Gulf of Finland. The purpose of these investigations, which were made during four research cruises in 1977-78, was to discover which microbiological parameters reveal terrestrial and littoral effects on the marine ecosystem. Microbial populations consistently decreased with increasing distance from the shore. The effects of terrestrial runoff, outflows from littoral areas and sediments were observed in the two Tvarminne inshore areas in the bacteria viable at 18C and the polymyxin-resistant bacteria, rods, and bacterial spores. Effects of these factors were not found in the Ajax area. The offshore microbial populations were characterized by vibrios and bacteria in a starved state. Neither offshore nor inshore conditions were indicated by proteolytic bacteria or yeasts. (Geiger-FRC)
W81-02641

INITIAL EFFECTS OF AMOCO CADIZ OIL ON INTERTIDAL ALGAE,
Brest Univ. (France). Inst. of Marine Studies.
J. Y. Floc'h, and M. Diouris.
Ambio, Vol 9, No 6, p 284-286, 1980. 6 Fig, 3 Ref.

Descriptors: *Amoco Cadiz, *Algae, *Marine algae, *Oil spills, Ecology, Marine plants, Intertidal areas, Aquatic algae, Phaeophyta, Chlorophyta, Rhodophyta, Environmental effects, Plant growth, Water pollution effects, Zonation, Vertical distribution, Distribution, Oil pollution, Ships, *France.

Fresh oil contacting algae after the Amoco Cadiz spill acted as a contact herbicide, bleaching the most sensitive filamentous green thalli (Cladophora and Chaetomorpha). Red algae developed local necrosis, and the sensitive brown algae developed widespread necrosis. Later exposure to weathered oil further weakened the plants, causing death of some species. Algae at higher tide levels in sheltered areas suffered drastic losses immediately after the spill, and losses continued for at least 8 months. A red alga, Rhodothamniella floridula, was replaced by a green alga, Enteromorpha. Lyngbya confervoides, a member of the Oscillatoriaceae, replaced the filamentous green algae, Cladophora and Chaetomorpha. At mid and lower tide levels, plants suffered less, especially those which remained immersed. Some less sensitive plants appeared stiffer, had periods of zero growth, and had weakened adhesion. Some changes in vertical zonation were possibly caused by changes in herbivore population. (Cassar-FRC)
W81-02642

MICROBIAL BIODEGRADATION AND CHEMICAL EVOLUTION OF OIL FROM THE AMOCO SPILL,
Montana State Univ., Bozeman. Dept. of Microbiology.
D. M. Ward, R. M. Atlas, P. D. Boehm, and J. A. Calder.
Ambio, Vol 9, No 6, p 277-283, 1980. 6 Fig, 4 Tab, 55 Ref.

Descriptors: *Microbial degradation, *Degradation(Decomposition), *Oil spills, Bacteria, Amoco Cadiz, Biodegradation, Chemical reactions, Oil pollution, Water pollution effects, Environmental effects, Ships, *France, Persistence.

Microbial degradation of oil spilled in the Amoco Cadiz wreck was not uniform because of the complex chemical composition of the oil and the variation in environmental conditions. Volatile materials evaporated or dissolved soon after the spill. Bacteria increased rapidly (at one site, from 96 million to 630 million total bacteria per gram; from 520 to 14 million hydrocarbon utilizing bacteria per gram) to digest the more easily degraded components, n-alkanes. Branched and cyclic aliphatic and aromatic components degraded more slowly. In aerobic, nutrient rich environments, 80% of the hydrocarbons were gone in 7 months. However, anaerobic conditions which are prevalent in sedi-

ments produced 5% degradation in 233 days in laboratory tests. Since some chemicals are not biodegradable and others remain in environments unfavorable to degradation, about 20% of the oil components may persist for a long period. (Cassar-FRC)
W81-02643

THE AMOCO CADIZ OIL SPILL: AN ECOLOGICAL IMPACT STUDY,
Centre Oceanologique de Bretagne. Brest (France).
L. Laubier.
Ambio, Vol 9, No 6, p 268-276, 1980. 9 Fig, 20 Ref.

Descriptors: *Amoco Cadiz, *Oil spills, *Ecology, *Environmental effects, Aquatic life, Ships, Oil pollution, Water pollution sources, Water pollution effects, Marine animals, Marine plants, Biodegradation, Transportation, *France, Shores, Seashores, Tidal waters.

When the Amoco Cadiz ran aground 1.5 nautical miles from shore at Portsall, Brittany, France, on March 16-17, 1978, 223,000 tons of crude oil were rapidly spilled into the ocean within 14 days. The toxic aromatic fraction was high, 30-35%. Prevailing winds at that time ensured that most of the oil reached the coast rather than remaining at sea. Immediately after the wreck, the French Ministry of the Environment began preparations for a 3-year study to monitor the chemical quality of the water, sediment, and marine organisms; study the ecological effects; and investigate microbial biodegradation processes. More than 2 years after the spill, the environment has largely recovered in areas where waves, currents, and wind work freely. Oil remains in the protected areas and is slowly undergoing microbial degradation. In addition to large numbers of marine animals lost initially, there are as yet unquantified sublethal and reproductive effects. Food chain alterations are not completely understood. The 3-year study program has been complicated by another oil spill in March, 1980. Nevertheless, it is believed that the first 2 years of study yielded about 80% of the expected information. (Cassar-FRC)
W81-02644

THE OIL SPILL AGE--FATE AND EFFECTS OF OIL IN THE MARINE ENVIRONMENT,
Centre National pour l'Exploitation des Oceans, Paris (France).
For primary bibliographic entry see Field 5B.
W81-02645

POLLUTION OF SUBTIDAL SEDIMENTS AND DISTURBANCE OF BENTHIC ANIMAL COMMUNITIES,
Station Biologique de Roscoff (France).
L. Cabioch.
Ambio, Vol 9, No 6, p 294-296, 1980. 3 Fig, 14 Ref.

Descriptors: *Amoco Cadiz, *Oil spills, *Benthic fauna, *Amphipoda, Marine animals, Water pollution effects, Sediments, Bottom sediments, Aquatic life, Crustaceans, Mollusks, Invertebrates, Ecology, Environmental effects, Ships, *France, Oil pollution.

The sublittoral zone was most affected by dissolved hydrocarbons and oil particles, free and adsorbed onto sediment, after the oil spill from the Amoco Cadiz wreck. In the first few weeks, bottom fauna living on the sediment surface were more adversely affected than burrowing fauna. Suspension and deposit feeders did not suffer from ingesting particles; the dissolved hydrocarbons were more harmful. The populations suffering the worst damage were inshore, at depths less than 30 meters, and living in fine sediments. An example is a community of Abra alba, a bivalve, and Ampelisca, an amphipod. About 40% of the total biomass was lost immediately after the spill. Some species were completely destroyed--amphipods, some mollusks, and sea urchins. At one severely polluted site, out of a total of 100 species, 11 were eliminated and 17 decreased in abundance. Repopulation has been difficult for some species, especially for those with no pelagic larvae. (Cassar-FRC)
W81-02646

5D. Waste Treatment Processes

WATER RECLAMATION BY COMBINED ELECTRODIALYSIS/ULTRAFILTRATION,
Aqua-chem, Inc., Milwaukee, WI.
B. Schneider.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-188559, Price codes: A10 in paper copy, A01 in microfiche. Final Report, Prepared for Office Water Research and Technology, April, 1980. 190 p. OWRT-C-80308-S(No 8575)(1), 1434-0001-8575.

Descriptors: *Water reuse, *Waste water treatment, *Membranes, *Tertiary treatment, *Electrodialysis, Water quality control, Water purification, Water reclamation, Filtration, Research and Development, Waste water(Pollution), Water pollution, Waste treatment, Reclamation, Dialysis, Separation techniques, Treatment, Membrane processes, Salts, Aquatic bacteria, Organic wastes.

It has been demonstrated that the combined use of electrodialysis (ED) and ultrafiltration (UF) in the same module represents a functional process for treating secondary effluents from conventional waste treatment processes. In this process, UF membranes afford separation and concentration of colloidal suspensions of bacteria and organics from the water and salts present in the solution. The UF membranes are located between ED membranes which form the depleting cells of a typical ED module, forming two depletion cells for every concentration cell. The ED membranes separate and concentrate the salts present in the secondary effluent, with fractionation into three solutions: (1) collodially-suspended materials, (2) a concentrated salt solution, and (3) the water with a portion of the original salt concentration and the dissolved organics. It would be more economical to employ UF and ED as separate processes to accomplish the tertiary treatment of a secondary effluent. A method for evaluating the overall performance of UF membranes is described. (Zielinski-IPA)
W81-02405

INVESTIGATION OF FULL-SCALE BIOLOGICAL BATCH TREATMENT OF INTERMITTENT WASTE WATER FLOWS,
Maryland Univ., College Park. Dept. of Civil Engineering.
J. E. Alleman, and S. P. Lo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185233, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, December, 1980. University of Maryland Water Resources Research Center Technical Report No 63. 31 p, 16 Fig, 1 Tab, 7 Ref. OWRT-A-052-MD(1), 14-34-0001-0122.

Descriptors: *Waste water treatment, Feasibility studies, *Aeration, *Activated sludge, *Biological treatment, Water pollution sources, Intermittent streams, Treatment, Municipal wastes, Waste treatment, Waste water(Pollution), Waste water disposal, Sludge, Aerobic bacteria, Biodegradation, Microbial degradation, Sludge treatment, Solids contact processes, Feasibility, Water quality, *Maryland, Greenbrier State Park.

An existing full-scale extended aeration waste water treatment plant, located at Greenbrier State Park, was modified to provide batch or intermittent discharge operation. Following modification, this plant was maintained in this operational mode for over a month, while successfully meeting all applicable NPDES permit criteria. It was believed that this periodic strategy for waste water treatment systems offers a potential for improved operation, manpower needs, and resistance to transient influent loads. Some aeration problems were experienced, in that since batch handling resulted in variable aeration tank volume, the existing high power (20HP) mechanical unit was not functional since it operated at fixed free water surface height. Addition of a supplemental bubble diffuser lacked sufficient blower horsepower (3 HP) for complete solids entrainment. Solids that settled went septic and became buoyant due to release of nitrogen via denitrification. The problem was alleviated by use of sub-surface effluent withdrawal, but sub-optimal performance was reflected. (Zielinski-IPA)
W81-02409

AQUIFERS AS PROCESSING PLANTS FOR THE MODIFICATION OF INJECTED WATER,
Louisiana State Univ., Baton Rouge. Dept. of Geology.
J. S. Hanor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185332, Price codes: A05 in paper copy, A01 in microfiche. Louisiana Water Resources Research Institute, Louisiana State University, Bulletin 11, August, 1980. 81 p, 26 Fig, 7 Tab, 47 Ref, 5 Append. OWRT-A-031-LA(6).

Descriptors: *Aquifer systems, *Aquifer testing, *Injection wells, Water purification, *Water treatment, Impaired water quality, Aquifers, Aquifer management, Aquifer characteristics, Bodies of water, Confined water, Water sources, Water supply, Water injection, Inflow, Water quality control, *Louisiana, Coastal aquifers.

Gulf Coast (Baton Rouge) Region aquifer systems offer potential for infested water storage and water composition modification. Study of natural processes on groundwater chemistry provides information on processes potentially influencing water composition during artificial recharge. Baton Rouge area fresh-water aquifer processes include fermentive breakdown of organic matter, sulfate reduction, Donnan behavior, and dissolution/formation of new silicates. Although appearing to be in exchange equilibrium with sediment clay minerals, ion-exchange influences native water composition less than previously thought. Potentially-occurring artificial recharge reactions (carbon dioxide formation and reaction with minerals; ion-exchange; diffusion) were studied. Altering montmorillonite appears to control water composition. Clay contents down to 0.1 weight-% rapidly cause dissolved calcium removal and water softening during simulated injection/storage/production of fresh waters from brackish/saline Gulf Coast aquifers, corroborating field study results. Aquiclude clays soften injected water only if pore water concentrations of calcium and magnesium are less than in injected water. Of a variety of other possible reactions/processes (oxidation-reduction; membrane effects), many are incompletely understood. (Zielinski-IPA)
W81-02412

PILOT PLANT STUDIES OF ROTATING BIOLOGICAL CONTACTORS TREATING MUNICIPAL WASTE WATER,
K. L. Murphy, and R. W. Wilson.
Canada Mortgage and Housing Corporation, Ottawa, Sewage Collection and Treatment Report SCAT-2, July, 1980. 117 p, 41 Fig, 22 Tab, 2 Append.

Descriptors: *Pilot plants, *Design criteria, *Research priorities, *Municipal waste water, *Waste water treatment, Biological oxygen demand, Research facilities, Test facilities, Waste water, Nitrification, Contact beds, Waste water purification, Complete waste water treatment, Design standards, Standards, Water quality, Water quality control, Impaired water quality, Quality control, Specifications.

This 12-month pilot program examined the performance of rotating biological contactors (RBC) for treatment of municipal waste water. Suitable design criteria for removal of BOD-5 and combined BOD-5 plus nitrification were examined. Phosphorus removal, the effects of diurnal and shock loadings, and considerations of process scale-up were also evaluated. The best design parameters for evaluation and sizing of the RBC systems were (1) total BOD-5 mass loading for BOD-5 removal, and (2) filtrable TKN mass loading for combined BOD-5 removal plus nitrifica-

tion. Treated effluent containing filtrable BOD-5 concentrations of less than ten milligrams/liter could be consistently produced. Recommended design loadings were developed, based on a full-scale short hydraulic detention RBC system experiencing a peak-to-mean-to-minimum diurnal flow of 2:1:0.5, with specific application to primary treated municipal waste water. It was concluded that diurnal factors of 1.25 and 1.35, respectively, for BOD-5 removal and combined BOD-5 removal plus nitrification should be used when designing full-scale RBC systems based on steady-state test data. (Zielinski-IPA)
W81-02438

ACTIVATED SLUDGE AND ACTIVATED CARBON TREATMENT OF A WOOD PRESERVING EFFLUENT CONTAINING PENTACHLOROPHENOL,
Department of the Environment, Ottawa (Ontario).
P. H. M. Guo, P. J. A. Fowlie, V. W. Cairns, and B. E. Jank.
Technology Development Report EPS 4-WP-80-2, June, 1980. 77 p, 38 Fig, 16 Tab, 13 Ref, 3 Append.

Descriptors: *Activated sludge, *Activated carbon, Water pollution sources, *Phenols, Chlorinated hydrocarbons, *Waste water treatment, Carbon, *Industrial wastes, Organic compounds, Organic pesticides, Preservation, Activated sludge process, Sludge, Adsorbents, Pollutants, Water pollution effects, Water pollution control, Water quality control, Water quality, Copper compounds, Creosote, Wood preserving industry, Ontario.

A comprehensive sampling/monitoring program was undertaken by the Waste Water Technology Centre, Burlington, Ontario, carried out in three phases from November 1977 to May 1978 at the activated sludge (AS) system at Abitibi-Northern Wood Preserves Limited (using creosote, pentachlorophenol (PCP), and chromated copper arsenate (CCA)), at Thunder Bay, Ontario. Phase 1 involved monitoring and upgrading the existing full-scale AS system; phase 2, treatment of the AS effluent by a granular activated carbon column system; phase 3, by-pass of the AS system and, following oil separation and flow equalization, waste water treatment in the activated carbon system. Waste water treatment after oil separation and flow equalization by extended aeration AS gave good removal of organics, but only 35% of the PCP, resulting in a toxic effluent to rainbow trout. Treatment of the AS effluent by carbon adsorption resulted in effective PCP removal and non-toxic effluents. Activated carbon treatment of waste water after oil separation and flow equalization gave good removals of organics and PCP. (Zielinski-IPA)
W81-02441

ADVANCED WASTE TREATMENT OF INDUSTRIAL WASTE WATERS FOR NON-POTABLE REUSE USING MOBILE TREATMENT UNITS,
Rexnord, Inc., Milwaukee, WI. Environmental Research Center.
R. Osantowski, A. Geinopolos, J. Kane, G. Rollinger, and R. Wullschleger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-189805, Price codes: A20 in paper copy, A01 in microfiche. Office of Water Research Technology Report OWRT/RU-80-5, January 1, 1981. 442 p, 57 Fig, 137 Tab, 33 Ref, 7 Append. OWRT-C-90084-R(No 7805)(2), 14-34-0001-7805.

Descriptors: *Waste water treatment, *Pilot plants *Water quality control, *Water reuse, Technology, Advanced waste water treatment, Water treatment facilities, Waste water facilities, Water treatment, Water pollution control, Waste water management, Waste water pollution, Waste water, Process control, Water quality, Treated water, Water use, Ion exchange, Reverse osmosis, Electrodialysis.

A pilot plant program was conducted to study the applicability of advanced treatment methods (chemical treatment, filtration, activated carbon sorption, ion-exchange, reverse osmosis, and electrodialysis, singly and/or in combination) for industrial waste waters, and was performed using mobile treatment facilities containing desalting and pretreatment equipment. The study, generated at three industrial sites (paper mill; food products plant; an organic chemicals complex), evaluated the advanced waste treatment methods for upgrading secondary effluent for non-potable industrial reuse. These methods removed residual contaminants such as dissolved and suspended solids, BOD-5, TOD, COD, and color. It was concluded that : (1) chemical treatment and dual media filtration effectively removed residual suspended solids and served as an effective pretreatment requisite for other methods studied; (2) activated carbon reliably removed soluble organics in providing pretreatment for the ion-exchange and electrodialysis processes; and (3) all of the desalting techniques studied, ion-exchange, reverse osmosis and electrodialysis are capable of producing a high quality, low dissolved solids water suitable for non-potable industrial reuse. All of these advanced technologies would require suitable pretreatment. (Zielinski-IPA)
W81-02489

LIGNITE LIQUEFACTION WASTE WATER: SUITABILITY FOR REUSE AND CLEAN UP FOR DISCHARGE INTO THE ENVIRONMENT,
North Dakota Univ., Grand Forks. Dept. of Chemistry.
R. J. Baltisberger, and D. E. Bartak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-189813, Price Codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, 1979. 44 p, 7 Fig, 11 Tab, 11 Ref. OWRT-C-7188(No 6218)(1).

Descriptors: *Waste water treatment, *Lignite, *Liquefaction, Waste water, Chemical compounds, Phenol, Ammonia, Polynuclear aromatic hydrocarbons, Extraction, Vaporization, Biological treatment, Byproducts, Leaching.

Treatment of waste waters produced by a lignite liquefaction process development unit is described. Approximately fifty pounds of waste water are generated for every 100 pounds of lignite (MAF basis) in the production of Solvent Refined Lignite. The principle chemical compounds present in the waste water were: phenol, 3,000-5,000 ppm; cresol, 2,000 ppm; methanol, 3,000 ppm; acetone, 3,000-5,000 ppm; ammonium ion, 3,000-5,000 ppm; acetate ion, 10,000-15,000 ppm; and bicarbonate ion, 2,000-6,000 ppm. Heavy metal cation concentrations were less than 1 ppm and a few polynuclear aromatic hydrocarbons (phenanthrene, methylphenanthrene,and pyrene) were present in concentrations less than 10 ppm. The most effective method of treating the waste water is: (1) a solvent extraction step to reduce the high phenol and cresol concentration to a few 100 ppm, (2) a vaporization of ammonia produced by adjustment of the waste water to pH 12, (3) adjustment to pH 6.5 with the remaining phenol removed by biological degradation, (4) final charcoal filtration to remove the last traces of phenol to a few ppb level. A by-product of the solvent refining process was filter cake containing too high a concentration of unremoved SRL and unreacted coal (about 60% carbon) to be buried at a mine site, because of economic considerations. The filter cake was ashed in a manner to duplicate the conditions in a slagging gasifier for the production of CO and H2. The resulting ash was then leached with water in column experiments to stimulate percolation of groundwater through mine buried ash obtained from the gasifier. No extensive quantities of ions were added to the leachate in the process.
W81-02490

EVALUATION OF SORBENTS FOR INDUSTRIAL SLUDGE LEACHATE TREATMENT,
New Jersey Inst. of Technology, Newark.
P. C. Chan, J. W. Liskowitz, A. Perna, and R. Trattner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-205800, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-052, June, 1980. 56 p, 15 Fig, 10 Tab, 17 Ref, 1 Append. R 803717 02.

Descriptors: *Leachates, *Industrial wastes, *Sludge disposal, *Waste water treatment, Calcium compounds, Zeolites, Kaolinite, Illite, Fly ash, Lysimeters, Landfills, Clays, Costs.

Ashes, clays, and refined materials were tested under laboratory and pilot-scale conditions to determine their capacity to remove leachate contaminants produced from three industrial sludges: calcium fluoride, metal hydroxide, and petroleum. Rather than a single sorbent, a combination of acidic and basic sorbents is required in a layered system for removal of all the measurable contaminants from the leachates. These combinations are illite, vermiculite, and a natural zeolite for the acidic leachate; illite, acidic fly ash for the neutral leachate; and illite, kaolinite, and a natural zeolite for the alkaline leachate. The sorbent capacities exhibited by the natural sorbents are comparable to those exhibited by refined sorbents. The outdoor pilot study, which was limited to the treatment of the calcium fluoride sludge leachate, using lysimeters, some 80 times larger than the laboratory lysimeters, revealed that the sorbent effectiveness depends on the velocity of the leachate through the sorbents and the sorbent removal capacity for specific contaminants. Except for magnesium, effective reductions of the measurable leachate constituents were achieved with the use of illite, acidic fly ash, and a zeolite in the weight ratio of 2:2:1. Sorbent costs have been estimated for various combinations required for treating leachate from calcium fluoride sludge over a ten-year period of landfill operation. For the illite/acidic fly ash/zeolite combination and the illite/acidic fly ash/basic fly ash combination, costs are $1.37 and $0.45 per ton of sludge, respectively. (Moore-SRC)
W81-02503

CHEMICAL AND BIOLOGICAL TREATMENT OF THERMALLY CONDITIONED SLUDGE RECYCLE LIQUORS,
Burgess and Niple Ltd., Columbus, OH.
For primary bibliographic entry see Field 5E.
W81-02506

TRUCK WASHING TERMINAL WATER POLLUTION CONTROL,
Matlack, Inc., Lansdowne, PA.
J. E. O'Brien.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-219090, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-161, June, 1980. 91 p, 22 Fig, 32 Tab, 3 Ref. S803656-01.

Descriptors: *Waste water treatment, *Industrial wastes, *Wash water, Oily water, Pilot plants, Ozone, Ultraviolet radiation, Organic wastes, Chemical treatment, Biological treatment, Chemical oxygen demand, Costs.

A laboratory and pilot-scale investigation of a treatment sequence, including physical, chemical, and biological treatment steps led to a full-scale installation for the treatment of tank truck washing waste water. The system included gravity separation equalization, neutralization, dissolved air flotation, mixed-media filtration, carbon adsorption, and biological treatment. This facility treated 15,000 gallons per day of waste water from the Matlack, truck washing terminal, Swedesboro, New Jersey, for proposed subsequent discharge to a tributary of the Delaware River. Following pretreatment for the removal of suspended solids and insoluble oils and greases, carbon adsorption was used for detoxifying the waste water prior to biological stabilization. The total system demonstrated an overall treatment effectiveness averaging greater than 90% removal of COD and 99% removal of oils and greases and phenolic compounds. The cost of treatment was $48.92 per 1,000 gallons of waste water treated. This equated to a unit cost of $24.46 per trailer cleaned. A toxic substance study indicated that organic compounds were eliminated through the treatment train. A further pilot plant investigation was made to determine if chemical oxidation through the use of ozone or ozone plus

untraviolet could be substituted for activated carbon to reduce COD and transform toxic organics to a biodegradable form. The ozone - ultraviolet process can consistently remove 80 to 90% of the dissolved organics from tank truck cleanings. (Moore-SRC)
W81-02527

ELECTROLYTIC TREATMENT OF OILY WASTE WATER FROM MANUFACTURING AND MACHINING PLANTS,
Ford Motor Co., Dearborn, MI.
R. L. Gealer, A. Golovoy, and M. Weintraub.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-225113, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-143, June, 1980. 57 p, 7 Fig, 12 Tab, 8 Ref. S804174.

Descriptors: *Waste water treatment, *Oily water, *Industrial wastes, Electrolysis, Emulsions, Pilot plants, Coolants, Oil, Cost analysis.

Process waste water from metal working operations contains free or suspended oil and emulsified oil which must be removed before the water can be discharged or reused. These oils originate mainly from parts washer overflow and machining coolant dumping, and the concentration typically ranges from 1,000 to 10,000 ppm as emulsified oil. A continuous electrolytic treatment is being developed to remove the emulsified oil from dilute oily waste water streams. In this process, the waste water permeates through an iron chip bed anode and steel mesh cathode. A potential is applied to the electrodes, forming ferrous ions at the anode and hydroxyl ions at the cathode. The ferrous ions react in a complex manner with the emulsifying agents, destabilizing the emulsion and generating an oil rich floating sludge and essentially oil-free water. A pilot plant unit capable of processing about 5700 1/day (1500 gal/day) was designed, constructed, and evaluated at an actual plant site. Operating parameters and process equipment were evaluated to assess the potential and problems of the process. Waste water with initial oil concentrations in the range of 300 to 7,000 ppm of solvent extractables has been reduced to less than 50 ppm in 90% of the test runs, and to less than 25 ppm in 83%. These test runs were done at conditions of minimum operating cost and minimum sludge generation. When necessary, freon extractables generally are reducible to about 10 ppm or less by the addition of more electrolytically dissolved iron to the system at a small increase in cost. Preliminary economics look favorable and overall results are quite encouraging so that further scale-up of the process is recommended. (Moore-SRC)
W81-02529

UNSLAKED LIME--ITS DIRECT USE IN PHOSPHORUS REMOVAL PROCESSES.
Department of the Environment, Ottawa (Ontario). Waste Water Technology Centre.
Canada-Ontario Agreement on Great Lakes Water Quality, Research Program Project 71-3-1. Research Report No 105, 1980. 24 p, 6 Fig, 14 Tab, 18 Ref.

Descriptors: *Waste water treatment, *Lime, *Phosphorus removal, *Canada, Waste water analysis, Pilot plants, Water quality control, Phosphorus, Phosphates, Water treatment facilities, Waste water facilities, Water treatment, Surface water, Eutrophication, Water pollution control, Water pollution prevention, Waste water pollution, Waste water management, Waste water, Technology, Process control, Water quality.

This study was carried out at the Waste water Technology Centre, Environment Canada, where a 1.5 liter/second (20 imperial gallons/minute) primary treatment plant with a quicklime/dry hydrated lime chemical addition system was built and operated. The study evaluated the use of quicklime for phosphorus removal. It was determined that quicklime may be used in place of hydrated lime without an increase in the lime requirement, provided that the lime slaking temperature was within 60-82C and the water/quicklime weight ratio was 6-10 at a slaking reactor detention time range of 5-50 minutes. A quicklime feed preparation system was developed and the full-scale system designed and discussed. To achieve the same pH in the treatment process, it was 1.25 times by weight of hydrated lime that quicklime was required. Treatment using slaked quicklime or hydrated lime gave the same reduction of total phosphorus, soluble phosphorus, BOD, and suspended solids, and similar sludge production rates. All quicklimes tested could be satisfactorily fed from conventional dry feeders. When quicklime was used arching/flooding from the chemical hopper was considerably lessened and lime buildup on dissolving tank side walls was reduced. (Zielinski-IPA)
W81-02545

EFFECT OF PRETREATMENT ON GROUNDWATER CONTAMINATION FROM LEACHING BEDS,
Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
M. M. Ali.
Research Publication No 83, July, 1980. 102 p, 29 Fig, 14 Tab, 20 Ref.

Descriptors: *Groundwater pollution, *Leaching, *Waste water treatment, *Effluents, *Sewers, Soil contamination, Soil columns, Water quality control, Water pollution, Groundwater movement, Groundwater, Surface-groundwater relations, Groundwater management, Leachates, Infiltration, Soil solution, Effluent streams, Effluent seepage, Soil analysis, Waste water facilities.

A simultaneous field and laboratory study was conducted at the Unionville Sewage Treatment Plant Site and at the Ministry of the Environment Applied Sciences Laboratory. In the field study, three types of effluents (septic tank (anaerobic); secondary treatment plant (aerobic); polishing lagoon (after secondary treatment)) were disposed into the ground using subsurface disposal systems to determine groundwater contamination levels and contaminant movement. In the laboratory study, the same three effluents were passed through three different sets of three identical soil columns containing soils from the three effluent disposal sites. Subsurface disposal caused groundwater quality degradation; septic tank effluent gave the highest contamination level, followed by secondary, followed by lagoon effluent. Soil column studies showed that pretreatment producing aerobic effluents has beneficial effect on contaminant removal efficiency of soil. Contaminants formed their own typical dispersion plumes in a wedge-shape spread along the groundwater direction. Subsurface movement and dispersion of contaminants varied with the hydrogeological factors and subsoil conditions. Contaminant concentrations were highest at the discharge point, decreasing gradually with increased distance from the source. (Zielinski-IPA)
W81-02548

ROLE OF NEMATODE-BACTERIAL INTERACTIONS IN HETEROTROPHIC SYSTEMS WITH EMPHASIS ON SEWAGE SLUDGE DECOMPOSITION,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse. Dept. of Environmental and Forestry Biology.
B. I. Abrams, and M. J. Mitchell.
Oikos, Vol 35, No 3, p 404-410, November, 1980. 3 Fig, 2 Tab, 30 Ref.

Descriptors: *Bacteria, *Nematodes, *Sludge digestion, Biodegradation, Sewage sludge, Microbial degradation, Sludge treatment, Waste treatment, Biological treatment, Aerobic treatment, Microorganisms.

Sterilized sewage sludge was used as the substrate for two types of biological decomposition systems--bacteria, Pseudomonas fluorescens (Trevisan), the same bacteria with the nematode, Pelodera punctata (Cobb). For all trials, the bacteria-nematode systems had greater oxygen consumption, 6 times as much at 22C during a period of maximum activity. The nematodes accounted for only 5% of the total metabolism (7.14 microliters oxygen per hour per mg dry weight at 22C). Percentages of organic matter lost over 35 days at 5, 12, and 22C respectively were bacteria alone, 1.37, 2.47, and 3.51; bacteria-nematode, 2.52, 6.09, and 6.89. Nematode populations doubled in 24 days at 5C, 5 days at 11C, and 2.2 days at 22C. Nematodes stimulated bacterial activity, possibly from the grazing effect, from aeration, and from the transport of bacteria through the soil. In nematode-bacteria systems, bacterial growth was evident down to 4 cm, the depth of nematode activity; in bacterial systems, 2 cm. (Cassar-FRC)
W81-02551

BAYER TOWER BIOLOGY - AN EFFICIENT, LOW NOISE AND ODOR-FREE PROCESS FOR BIOLOGICAL WASTE WATER TREATMENT,
Bayer A. G., Leverkusen (Germany, F.R.) Dept. of Applied Physics.
E. Schellmann.
Progress in Water Technology, Vol 12, p 215-232, 1980. 15 Fig, 8 Ref.

Descriptors: *Biological treatment, *Operating costs, *Waste water treatment, Odor, Economics, West Germany, Biochemical oxygen demand, Aeration, Bubbles, Incineration, Adsorption, Absorption, Oxygen, Insulation.

A new plant for the biological treatment of waste water is being constructed at BAYER AG, Leverkusen, West Germany. The facility features compact closed steel tanks instead of conventional large-area basins. Very-fine bubble aeration allows 33-50% savings on the amount of oxygen needed for an equivalent amount of oxygen absorption into the waste water compared to conventional liquid heights. The height of the new tank is 30 m, and air is distributed uniformly over the whole section of the tank to provide a large interfacial area. The long residence time of the gas bubbles affords more efficient oxygen utilization, resulting in reduced energy costs for air compression and a decreased production of off-gas. The expenses for off-gas incineration are also reduced. Odor and noise pollution of the new plant are strictly controlled by novel, economical devices. HCl is adsorbed with CaO, and noise from surface aerators is reduced by insulating the air compressor station. (Geiger-FRC)
W81-02553

NITRIFICATION KINETICS IN A ROTATING BIOLOGICAL DISK REACTOR,
Miyazaki Univ. (Japan). Dept. of Civil Engineering.
Y. Watanabe, M. Ishiguro, and K. Nishidome.
Progress in Water Technology, Vol 12, p 233-251, 1980. 19 Fig, 2 Tab, 21 Ref.

Descriptors: *Nitrification, *Model studies, *Ammonia, *Kinetics, Temperature, Pressure, Biological treatment, Diffusion, Penetration, Permeability, Biological membranes, Mathematical studies.

A steady state kinetic model was developed to describe ammonia oxidation (nitrification) in a rotating biological disk (RBD). The model utilizes the process of molecular diffusion along with a zero-order nitrification reaction in the biofilm. The nitrification rate/unit disk area is described as the product of an overall rate constant and an equilibrium level of bulk ammonia. The overall rate constant consists of a coefficient for the transport of ammonia to the biofilm surface and a coefficient expressing this process with a simultaneous zero-order nitrification reaction within the biofilm. A bulk first-order reaction proceeds at very low ammonia concentrations due to the rate limiting process of ammonia transport to the biofilm surface. Half-order and zero-order kinetics occur as bulk ammonia levels increase with respect to ammonia levels in the biofilm surface. These processes are affected by the penetrability of oxygen and ammonia into the biofilm. When the penetration thickness of oxygen is greater than that of ammonia, a half-order reaction takes place. A zero-order reaction occurs when the ammonia penetrability exceeds that of oxygen. At ammonia equilibrium levels, the transition from half- to zero-order kinet-

ics may take place depending upon the operating conditions. The model was applied to two completely-mixed flow reactors in a series of nitrification experiments. Results were in good agreement with model predictions when temperature, disk rotation velocity, partial pressure of oxygen in the gaseous phase, hydraulic loading and influent ammonia levels were varied. (Geiger-FRC)
W81-02554

PRACTICAL PROBLEMS RELATED TO NITROGEN BUBBLE FORMATION IN FIXED FILM REACTORS,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
P. Harremoes, J. C. Jansen, and G. H. Kristensen.
Progress in Water Technology, Vol 12, p 253-269, 1980. 10 Fig, 2 Tab, 16 Ref.

Descriptors: *Bubbles, *Denitrification, *Nitrogen, *Filters, Biological membranes, Biological treatment, Aeration, Pilot plants, Kinetics, *Waste water treatment, Mathematical studies, Model studies.

A pilot plant study has shown that during the denitrification of a nitrified effluent in a down-flow filter, nitrogen supersaturation and bubble formation take place and affect the performance of the reactor. Methanol provided the carbon and energy source, and the media size was 2-4 millimeters. A nitrogen build-up produced inside the biofilm was attributed to the diffusional resistance. Supersaturation always occurs in the biofilm before it takes place in the bulk water. An overall removal of 4 milligrams/liter NO3-N will lead to bubble formation in the bulk liquid which will disappear in rotating discs, coarse media filters and fluidized beds. In fine media filters, the bubbles may be trapped, giving rise to increased head loss and reduced removal rates. When a concentration of 6 milligrams NO3-N or greater is present in the bulk liquid, nitrogen content in the biofilm may exceed the saturation point, causing bubble formation between the biofilm and support media and detachment of the biofilm from the surface. When the turbulent shear is high, the biofilm will be sloughed off, and the resulting empty spaces will cause reduced overall performance. If the turbulent shear is low, the biofilm will be only partially detached, allowing it to flutter in the stream. When this occurs, it will be able to contribute more biofilm area on a continuous basis, which will improve performance per unit surface of the reactor. (Geiger-FRC)
W81-02555

DESIGN OF FIXED-FILM PROCESSES WITH STEADY-STATE-BIOFILM MODEL,
Stanford Univ., CA. Dept. of Civil Engineering.
B. E. Rittmann, and P. L. McCarty.
Progress in Water Technology, Vol 12, p 271-281, 1980. 4 Fig, 2 Tab, 26 Ref.

Descriptors: *Kinetics, *Model studies, *Biological treatment, Groundwater recharge, Pilot plants, Mathematical models, Denitrification, *Waste water treatment, Biological membranes, Chemical oxygen demand, Filters, Design criteria, Methane, Oxidation, Nitrification.

A previously described, fundamental model of biofilm kinetics has been used to predict biofilm performance, including the existence of a minimum substrate concentration. The single model was applied to full-scale systems treating different waste waters by various aerobic and anaerobic processes. The model was accurate in predicting the performance of larger fixed-film processes for denitrification, methanogenesis, and aerobic oxidation. The biofilm model was successful in predicting the steady-state removal of COD during groundwater recharge experiments. The model is based on independently obtained parameters of bacterial kinetics and mass transport for a steady-state biofilm, and the reactor configurations are fluidized and fixed-bed filters and a rotating disc. The model requires no fitting factors, and may be useful in recommending processes or in predicting when other processes will be inadequate for meeting design requirements. The model may also be applied as an aid in designing pilot and full-scale treatment facilities. (Geiger-FRC)
W81-02556

A GENERAL EQUILIBRIUM MODEL FOR THE PRECIPITATION OF PHOSPHATE WITH IRON AND ALUMINIUM,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
E. Arvin, and G. Peterson.
Progress in Water Technology, Vol 12, p 283-298, 1980. 4 Fig, 4 Tab, 13 Ref.

Descriptors: *Model studies, *Phosphates, *Chemical precipitation, Iron, Aluminum, Hydrogen ion concentration, Mathematical studies, Bicarbonates, Calcium, *Waste water treatment, Nutrients, Solubility, Separation techniques.

An equilibrium model was developed which closely simulated the experimental data from a number of batch and continuous, simultaneous- and post-precipitation systems for phosphate removal. The model is based on the assumption that all or part of the phosphate is precipitated as a complex containing calcium, iron (or aluminum), phosphate, and carbonate. A minimum solubility was observed in all of the experimental systems tested, which included a simultaneous precipitation pilot plant with addition of ferrous sulfate, a full scale post-precipitation plant using aluminum sulfate, and laboratory batch systems with sludge from pilot or full scale plants or synthetic waste water. Optimum pH values ranged from 6.6 to 8.8, depending on the dosage of the chemicals. Phosphate solubility may be reduced by increasing the calcium activity and decreasing the bicarbonate activity. The effects of calcium and bicarbonate may not be the same in simultaneous- and post-precipitation systems with iron additions; the effect of bicarbonate was significant only when the level of oxygen was decreased to near zero saturation. (Geiger-FRC)
W81-02557

NON-BIOLOGICAL ELIMINATION MECHANISMS IN A BIOLOGICAL SEWAGE TREATMENT PLANT,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
C. Matter-Muller, W. Gujer, W. Giger, and W. Stumm.
Progress in Water Technology, Vol 12, p 299-314, 1980. 5 Fig, 5 Tab, 20 Ref.

Descriptors: *Volatility, *Absorption, *Activated sludge, Biomass, *Waste water treatment, Organic wastes, Organic compounds, Municipal wastes, Biodegradation, Aromatic compounds, Biological treatment, Water pollution treatment, Pollutants.

Volatile organic pollutants that are non-biodegradable may be effectively removed from waste water by treatment in an activated sludge process. These substances are either absorbed into the sludge biomass or are volatilized with the oxygen transfer to the mixed liquor. The degree of absorption into the sludge biomass may be predicted from the lipophilicity of the substances, which is determined by their n-octanol-water distribution coefficients and is designated by a distribution equilibrium between the solids and the liquid. The volatilization of less lipophilic compounds can be associated with the mass transfer coefficient of oxygen and may be calculated from the critical volume of these substances. The validity of these two removal processes was investigated in two semi-technical activated sludge procedures operated in parallel by estimating a mass balance for four indicator compounds. The compounds used, n-heptadecane, Pristane PR, 1,2,4-trimethylbenzene, and p-dichlorobenzene, are indigenously present in the municipal wastes of Zurich. These compounds were removed with efficiency. Absorption of these pollutants into the biomass and volatilization are also important factors in evaluating the fate and residence time of refractory organics in natural water systems. (Geiger-FRC)
W81-02558

OPTIMAL ADVANCED TREATMENT AND PHOSPHOROUS REMOVAL BY DEEP BED FILTRATION,
Sulzer Brothers, Ltd., Winterthur (Switzerland). Water and Waste Water Treatment.
H. Gros, and B. Morgeli.
Progress in Water Technology, Vol 12, p 315-332, 1980. 11 Fig, 13 Ref.

Descriptors: *Filtration, *Phosphorus, *Flocculation, *Waste water treatment, Filters, Pilot plants, Switzerland, Separation techniques, Pressure, Flow rates, Municipal wastes, Industrial wastes, Design data.

An advanced waste water treatment system has been adopted by many Swiss cities for the removal of phosphorus. The new flocculation-filtration system was tested at a medium sized pilot plant with the aid of computer controlled operations. It was shown that very low phosphorus residues were permitted with the filtration process, and substantial savings were achieved in the second stage of phosphorus elimination. Pilot studies at the Aadorf waste water treatment plant were conducted to calculate the optimal bed height and filter media. The combined effects of pressure drop and flow velocity on the performance of the system were examined. The effects of long-term operating and backwashing on phosphorus removal efficiency were also evaluated. Comparisons of surface versus deep bed filtration are given. The new deep-bed filter system allows optimal operation at various filtration rates and high flocculant addition rates, which may result in reductions of the total amount of iron used for the different stages of phosphorus elimination. (Geiger-FRC)
W81-02559

A COMPARATIVE STUDY OF VARIOUS COAGULANTS FOR THE RENOVATION OF SECONDARY EFFLUENTS,
National Inst. for Water Research, Pretoria (South Africa).
L. R. J. van Vuuren, G. G. Cillie, J. van Leeuwen, and J. Prinsloo.
Progress in Water Technology, Vol 12, p 333-346, 1980. 9 Fig, 6 Tab, 7 Ref.

Descriptors: *Coagulation, *Reclaimed water, *Waste water treatment, Sludge treatment, Lime, Calcium carbonate, Water quality, Phosphorus, Iron compounds, Chlorination, Comparative costs, Water purification, Impaired water use, Water reuse, Water treatment.

Various compounds were evaluated as alternative coagulants for the renovation of activated sludge effluent in a 4,500 cu meter/day water reclamation facility. Adequate clarification and phosphorus removal were achieved with ferric chloride, aluminum sulfate and lime, with slightly better results when the last of these three was used. Lime treatment provided softening and good microbial control without interstage chlorination. During ferric chloride or aluminum sulfate clarification, interstage chlorination was required. High lime coagulation was the most expensive process, due to the high costs of sludge handling, maintenance and capital costs. Ferric chloride coagulation was the least expensive in terms of water reclamation costs. All three methods yielded reclaimed water of excellent chemical and microbial quality after further processing by breakpoint chlorination, sand filtration, ozonation, active carbon treatment, final chlorination and stabilization. The reuse application usually determines the choice of coagulant. Effluent quality and constant quality in terms of ammonia levels are important parameters in figuring water reclamation costs. (Geiger-FRC)
W81-02560

LIME TREATMENT OF WASTE WATER: DEVELOPMENT AND APPLICATION OF A SIMPLE GRAPHICAL TECHNIQUE FOR PREDICTING THE CHEMICAL COMPOSITION OF LIME-TREATED SECONDARY EFFLUENT,
National Inst. for Water Research, Pretoria (South Africa).
H. N. S. Wiechers, R. E. Loewenthal, and G. van

R. Marais.
Progress in Water Technology, Vol 12, p 347-358, 1980. 5 Fig, 1 Tab, 14 Ref.

Descriptors: *Waste water treatment, *Lime, *Model studies, Sewage treatment, Magnesium hydroxide, Calcium carbonate, Pilot plants, Alkalinity, Hydrogen ion concentration, Mathematical models, Water purification, Sludge, Phosphates.

The Modified Caldwell-Lawrence Diagram, a simple graphical model of the calcium-carbonate-magnesium system, was utilized to predict the chemical composition of stabilized lime-treated secondary effluent. The modified model utilized appropriate CaCO3 and Mg(OH)2 activity product constants instead of thermodynamic solubility product constants to predict: treated effluent pH; residual calcium, magnesium and total alkalinity; and the amount of lime needed to attain a specified effluent composition and to generate an associated mass of sludge. The model was applied to predicting the chemical composition of lime-treated secondary effluents at the Stander Water Reclamation plant, Pretoria, South Africa, and the Lebanon pilot plant, Ohio. Model results agreed closely with the experimental values, even though the effluents of the plants were of widely different composition and were treated under different reaction conditions. The present model should be of use to design engineers and plant operators in planning and using lime treatment systems. (Geiger-FRC)
W81-02561

KINETICS OF BIOLOGICAL FLUIDIZED BED WASTE WATER DENITRIFICATION,
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Center.
J. P. Stephenson, and K. L. Murphy.
Progress in Water Technology, Vol 12, p 159-171, 1980. 8 Fig, 6 Tab, 23 Ref.

Descriptors: *Kinetics, *Denitrification, Pilot plants, Municipal wastes, Nitrate, Nitrite, Model studies, Mathematical models, Temperature, Nitrogen, Biological treatment, *Waste water treatment.

Pilot scale tests were conducted to describe the kinetic performance of a biological fluidized bed reactor for the denitrification of municipal waste waters. To describe the denitrification process, a half-order kinetic model (8 to 48 milligrams/liter nitrate plus nitrite nitrogen) coupled with an Arrhenius temperature dependence relationship (4 to 27 degrees) was used. The rate of denitrification was affected very little by the hydraulic flux (0.25 to 1.7 cu meters/sq meter/minute) or the biofilm support media of granular activated carbon and sand. The fluidized bed process gave the same nitrate plus nitrite nitrogen removal under similar effluent waste water conditions and at volumetric denitrification rates about ten times faster than suspended growth or submerged rotating biological contactor methods. The temperature dependence of the removal rate was equivalent to that found in a packed column, but less than that of suspended growth or submerged rotating biological contactor techniques. (Geiger-FRC)
W81-02562

INDUSTRIAL WASTE CARBON SOURCES FOR BIOLOGICAL DENITRIFICATION,
Ontario Research Foundation, Mississauga.
J. D. Monteith, T. R. Bridle, and P. M. Sutton.
Progress in Water Technology, Vol 12, p 127-141, 1980. 7 Fig, 3 Tab, 15 Ref.

Descriptors: *Industrial wastes, *Denitrification, Biological treatment, *Waste water treatment, Cost analysis, Carbon, Nitrate, Nitrite, Economics, Waste treatment, Oil wastes.

Several industrial wastes or waste by-products were examined for their ability to replace methanol as the carbon source in biological denitrification treatment processes. This project, conducted by the Waste Water Technology Center, Burlington, Ontario, was aimed at reducing the costs of biological denitrification due to the increasing costs of methanol. After bench scale testing, thirty characterized waste waters were examined for batch denitrification rates. Twenty-seven of these showed rates of denitrification greater than or equal to that of methanol. The greatest denitrification rate occurred with a distillery fusel oil, and many of the wastes yielded substrate consumption rates equal to or less than that of methanol. A correlation was found between the initial FOC:N ratio and the substrate consumption ratio. Cost analyses showed that the use of industrial wastes in place of methanol as a carbon source in the denitrification process was very economical. (Geiger-FRC)
W81-02564

KINETIC MODEL OF BIOLOGICAL DENITRIFICATION IN A FLUIDIZED BED BIOFILM REACTOR (FBBR),
Westvaco Corp., NC. Charleston Research Center.
L. T. Mulcahy, W. K. Shieh, and E. J. LaMotta.
Progress in Water Technology, Vol 12, p 143-157, 1980. 5 Fig, 13 Ref.

Descriptors: *Model studies, *Denitrification, *Kinetics, Biological treatment, Mathematical studies, Nitrate, Nitrite, Diffusion, Equations, *Waste water treatment, Nitrogen.

A kinetic model was designed to describe the process of biological denitrification in a fluidized bed biofilm reactor (FBBR). An analysis of intrabiofilm diffusion and simultaneous zero order reaction is used to generate an effectiveness factor expression for individual biofilm covered particles in the FBBR. This individual particle cover is related to a one-dimensional reactor plug flow equation to give an overall kinetic model for convective transport along with biochemical conversion of nitrate in the heterogeneous reactor. To relate the biochemical conversion rate to the intrabiofilm diffusion rate, a modified Thiele modulus is proposed. For a Thiele modulus greater than 1.15, the FBBR is limited by diffusion, while 0.45 order kinetics are observed. When the Thiele modulus is less than 1.15, diffusion limiting factors are negligible and intrinsic zero order kinetics are found. When nitrate profiles from laboratory scale FBBR under various conditions of operation were compared to those predicted by the kinetic model, good agreement was found. (Geiger-FRC)
W81-02565

BIOLOGICAL NITROGEN REMOVAL BY STEP-FEED PROCESS,
Kurita Central Labs., Yokohama (Japan).
Y. Miyaji, M. Iwasaki, and Y. Sekigawa.
Progress in Water Technology, Vol 12, p 193-202, 1980. 10 Fig, 5 Tab, 5 Ref.

Descriptors: Theoretical analysis, *Denitrification, *Operating costs, Model studies, Biological treatment, Nitrification, Recycling, *Waste water treatment, Municipal wastes, Nitrogen, Recirculated water, Mathematical studies, Nitrate, Nitrite.

A new multi-stage, step-feed process was tested to reduce the operational costs of biological nitrogen removal by cutting consumption of chemicals and reducing power requirements. The new process employs denitrification and nitrification compartments which are arranged in a series into which waste water is fed and equally divided. Equations are presented and compared for the efficiency of nitrogen removal in the conventional one-stage step-feed system. Evaluation of the theoretical expressions shows that the recycling ratio can be greatly reduced in the new process, resulting in decreases in power costs. More than 90% removal of nitrogen was achieved in a night-soil treatment plant using the step-feed process without sodium hydroxide or methanol. The theoretical calculations of the new system proved valid when the method was applied to real operating conditions. The step-feed method may also be used in the treatment of municipal waste water where the power costs are strongly dependent on the amount of recirculation. (Geiger-FRC)
W81-02566

WASTE WATER TREATMENT PLANT FEATURES PUMPING FLEXIBILITY,
Superintendent of Water Pollution Control Plant and Sewer Lines.
G. Elbert, and M. L. Thornton.
Public Works, Vol 112, No 2, p 70-71, February, 1981.

Descriptors: *Waste water treatment, *Treatment facilities, *Pumps, Submersible pumps, Activated sludge, Indianola, Iowa.

A new waste water treatment plant at Indianola, Iowa, began operation in August 1979. It is unique in its use of submersible pumps to handle almost the entire process flow. Primary treatment facilities include two clarifiers and grit removal. Secondary treatment uses the activated biofilter process followed by short-term aeration and final clarification. Final clarifier effluent is pumped through mixed media filters. After chlorination, effluent is discharged to the Middle River. The plant contains a total of 28 submersible pumps which can be raised or lowered as necessary. Construction of dry wells was eliminated. The pumps are distributed as follows: headworks, four 35 hp and three 77 hp; prior to activated sludge biofilter, four 20 hp; secondary treatment, four 20 hp and one 77 hp for filter backwashing; sludge pumping, two 32 hp, two 2 hp, two 9.4 hp, and six variable speed. (Cassar-FRC)
W81-02568

MARINE BIOTECHNOLOGY AND THE USE OF ARID ZONES,
Commonwealth Scientific and Industrial Research Organization, South Melbourne (Australia). Div. of Chemical Technology.
For primary bibliographic entry see Field 3C.
W81-02570

MERCURY(II) SORPTION BY WASTE RUBBER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
W. R. Knocke, and L. H. Hemphill.
Water Research, Vol 15, No 2, p 275-282, February, 1981. 7 Fig, 3 Tab, 13 Ref.

Descriptors: *Absorption, *Mercury, *Synthetic rubber, Sorption, Water pollution, Kinetics, Waste water treatment, Hydrogen ion concentration, Temperatures, Particle size, Diffusion, Water pollution treatment, Sulfur compounds, Metals, Rubber, Vulcanized tire rubber.

Preliminary investigations on the removal of mercury from aquatic systems have shown rubber tire material to be a good absorbent of inorganic mercury in aqueous solutions. The kinetics of this sorption process were examined in batch tests using ground samples of vulcanized tire rubber. Parameters investigated included aqueous mercury levels, rubber sorbent particle size, pH and temperature of the reaction solution. To aid in identifying the mechanisms of mercury absorption, some sulfur-free rubber materials were also studied. Tire rubber proved to be an efficient remover of mercury from waste solutions. pH was the most influential of the parameters on the rate of mercury removal. For good removal of mercury, a pH range of 5.5-6.0 was recommended. The rate limiting step of mercury uptake was found to be the diffusion of mercury through the pores in the rubber sorbent. Sulfur-free rubbers were also effective in removing inorganic mercury from aqueous solutions. (Geiger-FRC)
W81-02572

ANAEROBIC TREATMENT KINETICS OF PALM OIL SLUDGE,
Singapore Univ. Dept. of Civil Engineering.
K. K. Chin.
Water Research, Vol 15, No 2, p 199-202, February, 1981. 4 Tab, 15 Ref.

Descriptors: *Sludge digestion, *Anaerobic digestion, *Oil wastes, Sludge treatment, Kinetics, Fermentation, Laboratory tests, Suspended solids, Waste water treatment, Operating costs, Recycling, Waste treatment, Biochemical oxygen demand, Chemical oxygen demand.

A completely-mixed, suspended growth continuous anaerobic fermentation system was evaluated in laboratory scale tests for the treatment of palm oil sludge. Tests were carried out in 20 liter PVC digesters, and progress of the treatment was monitored by daily measurements of gas production and composition. Biochemical oxygen demand, chemical oxygen demand (COD), alkalinity, volatile acids, volatile solids, pH and nitrogen were also measured at regular intervals. Biokinetic coefficients were calculated for systems with and without solids recycle. For units with solids retention times greater than 25 days, gas production rates averaged 0.9 liters/gram BOD, COD, and volatile suspended solids. The rates of gas production averaged about 0.9 liters/gram BOD used, with an energy yield of 20,000 J/g BOD utilized for units with solids retention times over 25 days. The minimum solids retention time was estimated to be greater than 10 days. However, the measured minimum solids retention time was actually less than 7 days. Other factors necessary for process stability are considered, along with operating costs and some possible energy saving modifications. (Geiger-FRC)
W81-02580

ANAEROBIC TREATMENT OF WASTES CONTAINING METHANOL AND HIGHER ALCOHOLS,
Agricultural Univ., Wageningen (Netherlands). Dept. of Water Pollution Control.
G. Lettinga, W. de Zeeuw, and E. Ouborg.
Water Research, Vol 15, No 2, p 171-182, February, 1981. 6 Fig, 5 Tab, 21 Ref.

Descriptors: *Fermentation, *Alcohols, *Anaerobic digestion, *Sludge digestion, Microbial degradation, Chemical oxygen demand, Sewage sludge, Waste water treatment, Biological treatment, Methane, Trace elements, Anaerobic bacteria, Volatility, Carbohydrates, Biodegradation.

Continuous and batch experiments were carried out to evaluate the anaerobic digestion of a fusel oil containing about 50% methanol and 50% higher alcohols. The 'Upflow Anaerobic Sludge Blanket' (UASB) process was used in the continuous experiments. This process employed a sugar beet waste-grown anaerobic (SBA) sludge as inoculum. The SBA sludge was highly settleable and superior to digested sewage sludge as seed material for the treatment process. The breakdown of higher alcohols starts immediately, and that of methanol, a few days later. Using the UASB system, a space sludge load of up to 20 kilograms chemical oxygen demand/cubic meter/day could be handled within the first week. Contrary to previous studies in the literature, the sludge is able to ferment volatile fatty acids (VFA) and methanol rapidly and simultaneously under favorable conditions. The presence of the right trace elements is important to the stability of the process. At present, the operation of a fail-proof anaerobic process for the treatment of methanolic wastes cannot be guaranteed. (Geiger-FRC)
W81-02584

SUBMERGED COMBUSTION FOR SLUDGE DIGESTION,
Water Services, Vol 84, No 1018, p 718-719, December, 1980.

Descriptors: *Submerged combustion, *Anaerobic digestion, *Sludge digestion, Sewage treatment, *Waste water treatment, Activated sludge, Digestion, Industrial wastes, Municipal wastes.

A 200,000 BTU submerged combustion unit for sludge digestion was installed at the Welshpool Sewage Treatment Works in November, 1978. Results to date indicate that digestion time was reduced to 12-15 days from 91 days for the customary cold retention time. The anaerobic digester is 15 m x 4.6 m x 2.7 m deep. It is maintained at 35C by burning natural gas at about 5.3 cu m per hour. Submerged combustion burners use a submerged flame burning below the liquid surface. This is very efficient (97% at 35C and 88% at 60C) and operates on any gas or liquid fuel having a calorific value greater than 150 BTU per cu foot. Applications for submerged combustion equipment are separation and neutralization of waste liquors, accelerated sludge digestion, killing pathogens, and recarbonation of alkaline industrial and municipal wastes. (Cassar-FRC)
W81-02587

AUTOMATIC COMPUTERIZED COMPUTATION OF AN OPTIMAL SEWERAGE NETWORK BY DYNAMIC PROGRAMMING,
Tahal Consulting Engineers Ltd., Tel Aviv (Israel).
For primary bibliographic entry see Field 6A.
W81-02588

COMPUTER-BASED MONITORING FOR AVONMOUTH STW.
For primary bibliographic entry see Field 7B.
W81-02589

RENOVATION OF WASTE WATER BY SOIL COLUMNS FLOODED WITH PRIMARY EFFLUENT,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
J. C. Lance, R. C. Rice, and R. G. Gilbert.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 381-388, February, 1980. 5 Fig, 2 Tab, 13 Ref.

Descriptors: *Waste water treatment, *Groundwater recharge, *Infiltration rates, Land disposal, Ultimate disposal, Vegetation effects, Nitrogen compounds, Phosphorus compounds, Phosphates, Organic compounds, Coliforms, Viruses, Disposal, Induced infiltration, *Water reuse.

The rapid infiltration method was used to flood soil columns (2.75 meters long and 15 cm diameter) with primary effluent to test the feasibility of this energy-saving method, which has been used successfully to remove pollutants from secondary effluent. The good removal rates obtained in laboratory studies show that the high-rate land filtration method may be used to treat primary effluent directly and eliminate secondary effluent treatment. Nitrogen removal was 45.6 and 81.8% for non-vegetated and vegetated columns, respectively. Phosphate-phosphorus levels ranged from 66 to 72% after a wave of phosphate was leached from the columns. This phosphate release was probably caused by the phosphate retained on the columns during previous experiments. Most of the organic carbon was removed - influent concentration, 75 mg per liter, and effluent, 6.9 mg per liter. Fecal coliforms concentration in the influent was 0.65 million to 20 million per 100 ml water. Soil adsorption removed all but 0 to 186 per 100 ml water. Coliform removal was the same on vegetated and non-vegetated columns. Poliovirus at a level of 12,000 plaque forming units per ml was totally absorbed in 80 cm. During 34 weeks of intermittent flooding, infiltration rates in soil columns exposed to the atmosphere declined by only 3%. During the second 34 weeks, infiltration dropped by 30%, indicating a need for cultivation. Infiltration rates were the same for vegetated and non-vegetated columns. Soil not exposed to sunlight had 50% reduced infiltration rates in 4 months of intermittent flooding. (Cassar-FRC)
W81-02603

THE ROLE OF ADSORPTION IN BIOLOGICALLY EXTENDED ACTIVATED CARBON COLUMNS,
Maine Univ., Orono.
J. D. Lowry, and C. E. Burkhead.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 389-398, February, 1980. 9 Fig, 4 Tab, 9 Ref.

Descriptors: *Activated carbon, *Adsorption, *Waste water treatment, Biodegradation, Sand, Coal, Organic compounds.

Activated carbon did not promote biological activity to a greater extent than sand and coal on water treatment adsorption columns. Activated carbon is more expensive, less durable, and much harder to backwash than sand. Data indicated that adsorption was not a factor in increased biological removal; in fact, the microorganisms on the surface impeded adsorption and caused a large pressure loss on the column. The author stated that the vast internal pore structure of activated carbon is unavailable to the large microorganisms, and therefore the activated carbon behaves no differently than a relatively inert medium. (Cassar-FRC)
W81-02604

EVALUATION OF EXTENDED AERATION ACTIVATED SLUDGE PACKAGE PLANTS,
WTC, Burlington (Ontario).
P. H. M. Guo, D. Thirumurthi, and B. E. Jank.
Journal of the Water Pollution Control Federation, Vol 53, No 1, p 33-42, January, 1981. 4 Fig, 8 Tab, 6 Ref.

Descriptors: *Package plants, *Activated sludge, *Performance, *Costs, *Waste water treatment, Operation and maintenance, National Sanitation Foundation, Aeration, On-site tests, Ice, Suspended solids, Biological oxygen demand, Evaluation, Quality control, Effluent.

Performance of 20 package waste water treatment plants produced by 6 different manufacturers was evaluated during May-October 1976 by the National Sanitation Foundation. Plants ranged in size from 8 to 454 cu m per day, and they all treated domestic wastes exclusively by the extended aeration activated sludge process. Only 4 of the plants produced effluent of satisfactory quality. Median BOD5 ranged from 37 to 290 mg per liter; suspended solids, 13 to 156 mg per liter. The major cause of poor performance was operator-related: insufficient manpower or lack of training. Other process and equipment problems were insufficient biomass, improper aeration, floating sludge, offensive odors, lack of sludge treatment facilities, mechanical breakdown of comminutors, clogging of air diffusers and sludge return systems, malfunction of the skimming device, and ice formation in the clarifiers. Design capacity and equipment cost were correlated. Using the equation provided, a 100 cu m per day plant would cost $45,000 as of 1977. Operating and maintenance costs for the 20 plants in 1975 ranged from $410 for a plant designed for 49 cu m per day and operating at 8 cu m per day to $4,840 for a 454 cu m per day plant operating at 173 cu m per day. (Cassar-FRC)
W81-02611

SOURCES OF SOLUBLE ORGANIC NITROGEN IN ACTIVATED SLUDGE EFFLUENTS
Stanford Univ., CA. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5B.
W81-02617

PRODUCTION OF SOLUBLE ORGANIC NITROGEN DURING ACTIVATED SLUDGE TREATMENT,
Stanford Univ., CA. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5B.
W81-02618

MUNICIPAL WASTE WATER REUTILIZATION ON CULTIVATED SOIL,
Brigham Young Univ., Provo, UT.
For primary bibliographic entry see Field 5E.
W81-02619

MIXING EFFICIENCIES IN FULL-SCALE AEROBIC DIGESTERS BY TRACER METHODS,
Canviro Ltd., Waterloo (Ontario).
H. D. Monteith, and J. P. Stephenson.
Journal of the Water Pollution Control Federation, Vol 53, No 1, p 78-84, January, 1981. 6 Fig, 16 R

Descriptors: *Mixing, *Anaerobic digestion, *Tracers, Digestion, Efficiencies, Sodium fluoride, *Waste water treatment.

Mixing patterns in two digester systems were studied with a sodium fluoride tracer. In the prim

digestion tanks, up to 77% of the volume was a dead zone with respect to active mixing. In another case, shortcircuiting allowed 61% of the throughput of the primary digester to avoid treatment. Transferring sludge from primary to secondary digester concurrent with sludge dewatering caused nearly 100% shortcircuiting. Inadequate mixing leads to many problems: incomplete stabilization of raw sludge, reduced energy recovery by methane gas production, reduced pathogenic organism destruction, and system overdesign. (Cassar-FRC)
W81-02620

ANAEROBIC DIGESTION OF BREWERY BY-PRODUCTS,
Pennsylvania Univ., PA. Dept. of Civil and Urban Engineering.
J. D. Keenan, and I. Kormi.
Journal of the Water Pollution Control Federation, Vol 53, No 1, p 66-77, January, 1981. 6 Fig, 8 Tab, 29 Ref.

Descriptors: *Brewery industry, *Anaerobic digestion, *Methane, Industrial wastes, *Waste water treatment, Gases, Digestion, Fermentation, Organic matter, Energy, Costs.

Mesophilic anaerobic fermentation reduced organic loading of brewery waste water and produced methane gas during laboratory tests with three 14 liter vessels. Most favorable conditions for digestion were 10 days retention time and a loading rate of 6 grams substrate per liter per day. At rates greater than this, digester failure occurred. Methane gas production was 0.33 liters at a loading rate of 2 g per liter per day and 0.30 liters at 6 g per liter per day. Gas production increased with detention time: 8 to 15 days, 0.32 to 0.41 liters per g dry substrate respectively. Cost estimates showed that a 1000 cu ft digestion plant could produce methane at a cost of $1.19 per million BTU. This represents 34% of the natural gas requirements of a brewery or 17% of total energy requirements. (Cassar-FRC)
W81-02621

VACUUM WASTE WATER COLLECTION: THE ALTERNATIVE SELECTED IN QUEEN ANNE'S COUNTY, MARYLAND,
O'Brien and Gere Engineers, Inc., Dover, DE.
A. F. Hassett, and J. C. Starnes.
Journal of the Water Pollution Control Federation, Vol 53, No 1, p 59-65, January, 1981. 2 Tab, 7 Ref.

Descriptors: *Queen Anne's County, Maryland, *Vacuum sewers, *Waste water, *Sewerage, Design criteria, Costs, Capital costs, Operating costs, Maintenance costs, *Waste water treatment.

Queen Anne's County, Maryland, has chosen the vacuum waste water collection system to serve a 5,000 population in a 766 hectare area of low-lying land interlaced with tidal creeks and bays. There are 1,800 residences and commercial establishments, including restaurants, marinas, and seafood processing plants. Present disposal is by on-site systems, most of which are malfunctioning. Vacuum sewers collect waste by maintaining negative pressure at central collection stations. When waste water from individual service has reached a given level in the holding tank, a pressure sensor opens a valve, allowing the material to be exhausted into the sewer line. The reintroduction of atmospheric air again closes the valve. Capital costs for several alternative systems are as follows: vacuum, $8.1 million; pressure, $10.4 million; and gravity, $15.5 million. Annual operating and maintenance costs are $893,000, $1.117 million, and $1.737 million respectively. Design criteria include an air to liquid ratio of 2:1, pressure differential of 5.6 meters, minimum pipe slope of 0.25%, one vacuum valve for every 2 residential units, waste water introduced in 10 gallon slugs, design peak flow 0.031 liters per second for each residential unit, 61,000 meters of sewers, and 1,050 vacuum valves. Difficulties in earlier systems are recognized and should be eliminated from this proposed system. (Cassar-FRC)
W81-02622

TESTING AERATION EQUIPMENT IN CONVENTIONAL ACTIVATED SLUDGE PLANTS,
Kansas Univ., Lawrence. Dept. of Environmental Engineering.
R. E. McKinney.
Journal of the Water Pollution Control Federation, Vol 53, No 1, p 48-58, January, 1981. 10 Fig, 10 Tab, 15 Ref.

Descriptors: *Activated sludge, *Aeration, *Oxygen demand, *Mixing, Operation, *Waste water treatment, Aerobic treatment, Dissolved oxygen, Milwaukee, Denver, Detroit, Memphis.

Evaluation of aeration in conventional activated sludge plants in 4 cities showed that measurement of oxygen uptake rate and dissolved oxygen at regular intervals along the length of the tank from influent to effluent end gave data useful in evaluating actual oxygen transfer. All tanks studied, from single-pass to ten-pass, showed the same rapid mixing pattern. The oxygen uptake rate dropped rapidly during the first third of the length of the tank, to a point of relatively constant decrease, at which the rate of decrease was controlled by the rate of oxygen transfer under oxygen limiting conditions. The change in oxygen uptake after the initial drop was used to evaluate the oxygen transfer rate. In aeration tanks where aerobic conditions were reached, the oxygen uptake rate at the point where the system became completely aerobic was used to check the value obtained under oxygen limiting conditions. (Cassar-FRC)
W81-02623

FAULT TREE ANALYSIS AND TREATMENT PLANT INSTRUMENTATION,
Tennessee Valley Authority, Muscle Shoals, AL.
D. L. Kelley, and R. C. Allison.
Journal of the Water Pollution Control Federation, Vol 53, No 1, p 43-47, January, 1981. 3 Fig, 1 Tab, 3 Ref.

Descriptors: *Instrumentation, *Monitoring, *Fault tree analysis, Analysis, *Waste water treatment, Control systems.

A monitoring system was designed for a small waste water treatment plant serving a town of 3000 people. The technique used was fault tree analysis, a concise and orderly description of the various occurrences within a system that can result in an undesirable event, such as failure of one of the treatment processes. The fault tree analysis of the chlorination process is shown in detail. Possible types of failure were pinpointed: primary, loss of chlorine gas flow; and secondary, insufficient chlorine gas flow--with consequences of each. Tertiary failures were those occurring outside the system, but affecting operations, e.g., cold temperatures. Using this analysis, sensors were easily assigned to desired points in the process. An input-output flow of the entire monitoring system shows 16 sensor points measuring levels, flows, turbidity, and pressure. (Cassar-FRC)
W81-02624

NITRIFICATION IN ROTATING BIOLOGICAL CONTACTORS,
Manhattan Coll. Bronx, NY. Environmental Engineering and Science Program.
J. A. Mueller, P. Paquin, and J. Famularo.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 688-710, April, 1980. 21 Fig, 9 Tab, 15 Ref.

Descriptors: *Mathematical models, *Nitrification, *Design, Temperature, Kinetics, *Waste water treatment, Biochemical oxygen demand, Calibrations, Mass transfer, Rotating biological contactors.

A model of rotating biological contactors (RBC) was developed, calibrated, and verified. The model is applicable to soluble organic carbon (BOD or COD) removal, nitrification, and soluble nitrogen removal. Material balance equations are numerically integrated to yield concentrations of the carbonaceous and nitrogenous substrates in the liquid film and biofilm attached to the rotating media, as well as concentrations in the mixed tank and effluent liquid from each stage. The model is successful because it incorporates the basic principles of mass transfer and simultaneous reaction in a steady-state mathematical model. The kinetic rate constants used to describe the performance of the Gladstone, Michigan plant were related by a temperature factor of 1.1. The model was tested for six different operating conditions for Gladstone, but further testing is recommended with waste waters of different character. The model allows the designer to describe process performance with a single set of temperature-corrected kinetic coefficients for a particular waste. (Small-FRC)
W81-02625

MECHANISM UNDERLYING THE REMOVAL OF ORGANIC MICROPOLLUTANTS DURING FLOCCULATION BY AN ALUMINUM OR IRON SALT,
Societe Lyonnaise des Eaux et de l'Eclairage (France).
P. Thebault, J. M. Cases, and F. Fiessinger.
Water Research, Vol 15, No 2, p 183-189, February, 1981. 7 Fig, 3 Tab, 19 Ref.

Descriptors: *Coagulation, *Organic wastes, Water pollution, Separation techniques, Adsorption, Flocculation, Pesticides, Lindane, *Waste water treatment, Minerals, Tertiary treatment, Organic compounds, Potable water.

The removal of micropollutants from waste waters during the coagulation step of treatment would provide a cost effective method for handling harmful organics. The possibility of using basic aluminum polychloride and ferric chloride for the removal of lindane, benzopyrene, diethylphthalate and dibutylphthalate was investigated in laboratory tests. Water samples taken from the western Paris distribution system and free of mineral colloids were spiked with known amounts of the micropollutant before coagulation-flocculation in an FLH6 Hydrocure flocculator. Generally, the reduction of the micropollutants was poor, except for benzopyrene, with a 62% reduction on both mineral coagulants. For lindane and benzopyrene, the adsorption isotherms were found to obey Henry's law. For diethyl- and dibutylphthalates, the adsorption was attributed to a first order phase change in the adsorbed layer due to the influence of lateral bonds. The efficiency of the removal should be improved by controlling the formation of Al or Fe coagulant species which would favor adsorption. (Geiger-FRC)
W81-02634

5E. Ultimate Disposal Of Wastes

SELECTED HYDROLOGIC DATA FROM THE VICINITY OF RAYBURNS AND VACHERIE SALT DOMES, NORTHERN LOUISIANA SALT-DOME BASIN,
Geological Survey, Baton Rouge, LA. Water Resources Div.
G. N. Ryals, and R. L. Hosman.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $2.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-217, July, 1980. 17 p, 3 Fig, 7 Tab, 5 Ref, 2 Plates.

Descriptors: *Hydrologic data, *Nuclear wastes, *Underground waste disposal, *Radioactive waste disposal, *Louisiana, Water quality, Hydrogeology, Groundwater movement, Surface-groundwater relationships, Water analysis, Radiochemical analysis, Hydrographs, Northern Louisiana salt-dome basin, Rayburns salt dome(LA), Vacherie salt dome(LA).

The U.S. Department of Energy is considering salt domes in northern Louisiana as possible sites for storage of nuclear waste. As part of this National Waste Terminal Storage (NWTS) Program, the U.S. Geological Survey is conducting a regional study of the geohydrology of the northern Louisiana salt-dome basin. Field studies involving the collection of data began in 1977. Data-collection networks were established for both ground- and surface- water sources, primarily in the vicinity of

two salt domes, Rayburns and Vacherie. Groundwater data collection involved measuring water levels and sampling existing production wells and test wells drilled by the Louisiana State University for Environmental Studies. Samples were analyzed for one or more of the following categories of chemical constituents: inorganic, trace metal, and radiochemical. A network of surface-water stations was set up for measuring discharge and collecting periodic samples. Initial sampling was for analysis for inorganic chemical constituents and radioactive elements. Subsequent sampling has been for inorganic chemical constituents. (USGS)
W81-02456

GEOHYDROLOGY OF THE KEECHI, MOUNT SYLVAN, OAKWOOD, AND PALESTINE SALT DOMES IN THE NORTHEAST TEXAS SALT-DOME BASIN,
Geological Survey, Austin, TX. Water Resources Div.
J. E. Carr, S. J. Halasz, and H. B. Peters.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $12.00 in paper copy, $7.75 in microfiche. Geological Survey Open-File Report 80-2044 (WRI), 1980. 39 p, 18 Fig, 1 Tab, 98 Ref.

Descriptors: *Hydrogeology, *Radioactive waste disposal, *Groundwater, *Aquifers, *Texas, Aquifer characteristics, Groundwater movement, Geohydrologic units, Evaluation, Northeast Texas, Salt domes.

The U.S. Department of Energy is considering the feasibility of using salt domes in the northeast Texas salt-dome basin as repositories for radioactive wastes that may require complete confinement for as much as 250,000 years. Four of fourteen known shallow piercement salt domes within the basin--Keechi, Mount Sylvan, Oakwood, and Palestine Salt Domes--have been selected as candidate domes for further study and possible selection as storage sites. Dissolution may exist at all four candidate salt domes, possibly through contact with Cretaceous or Tertiary aquifers, or through fault systems in the vicinity of the domes. Strata overlying and surrounding Palestine and Keechi Salt Domes have been arched into steeply-dipping folds that are complexly faulted. Similar conditions exist at Oakwood and Mount Sylvan Domes, except that the Tertiary strata have been only moderately disturbed. Cap rock, which is generally accepted to be an indication of salt dissolution, is present in varying amounts over all four domes. Saline water has been reported at the surface at all candidate domes except Oakwood, but only two water wells near the domes yield water containing possible anomalous concentrations of dissolved chloride--one at Keechi and one at Oakwood. Possible subsurface plumes of saline water, which are indications of instability, exist at all four domes. Additional problems concerning the hydrologic stability of Oakwood and Palestine salt domes have resulted from the disposal of oil-field saline water in the cap rock at the Oakwood dome and previous solution mining of salt at the Palestine dome. Additional investigations are needed to determine if a selected dome is hydrologically stable. Needed investigations include (1) more complete comparative analysis of the regional and local geohydrologic system; (2) a site-specific drilling and sampling program to analyze the cap rock-aquifer boundary, sediment distribution, hydraulic-parameter variations, hydraulic-head relationships, and hydrochemical patterns; and (3) mass-transport computer modeling of groundwater flow at the domes. (USGS)
W81-02482

REMOVAL AND RECOVERY OF METALS AND PHOSPHATES FROM MUNICIPAL SEWAGE SLUDGE,
Waterloo Univ. (Ontario). Dept. of Chemical Engineering.
D. S. Scott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-221245, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-037, June, 1980. 45 p, 3 Fig, 15 Tab, 25 Ref. R-804669.

Descriptors: *Sludge disposal, *Metals, *Waste recovery, *Cost analysis, *Incineration, Chemical sludge, Activated sludge, Heavy metals, Waste water treatment, Phosphorus removal, Iron, Aluminum, Zinc, Magnesium, Nickel, Manganese, Chromium, Copper, Lead.

Incineration is the most rapidly growing method of sludge disposal despite problems with the quantity, and the phosphate and metals content of the ash. If it were possible to remove metals and phosphates from sludge prior to incineration, the resulting ash would be innocuous with a low metal content, the ash volumes would be reduced and the calorific value of the sludge feed to the incinerator would be enhanced. The technical and economic aspects of acid extracting heavy metals and phosphates from municipal chemical sludges and subsequently recovering them by lime neutralization were studied using an anaerobically digested chemical sludge to which ferric chloride had been added as a phosphate precipitant, and an aerobic waste activated sludge to which alum had been added for phosphate control. Adequate extractions of phosphorus, iron, aluminum, zinc, magnesium, nickel and manganese can be obtained from either sludge or filter cake at a pH of 1.5, using sulfuric acid. Chromium extractions vary from 50% to 90%, and copper cannot be extracted from anaerobic sludge, but does extract from aerobic systems. Lead is not extracted. The resulting acid extracted residual solids show removal of from 50% to 70% of the ash-forming inorganics. The calorific value increases from 30% to 40%. The cost of the extraction and recovery process is such that the value of recovered chemicals or metals will only pay 20% to 30% of estimated annual total cost. The major cost factor is the expense of reagents for recovery of chemicals. (Moore-SRC)
W81-02505

CHEMICAL AND BIOLOGICAL TREATMENT OF THERMALLY CONDITIONED SLUDGE RECYCLE LIQUORS,
Burgess and Niple Ltd., Columbus, OH.
M. B. Heyda, J. D. Edwards, and R. F. Noland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-213085, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-020, June, 1980. 75 p, 17 Fig, 22 Tab, 29 Ref. 11010 DKI.

Descriptors: *Sludge disposal, *Chemical treatment, *Biological treatment, Color removal, Waste water treatment, Biological oxygen demand, Heat treatment, Costs, Recycling, Lime, Clarification, Activated sludge process, Thermal conditioning.

Some municipal waste water treatment facilities use thermal conditioning as a sludge processing method. A by-product of this process is a highly concentrated recycle liquor which is often returned to the main treatment facilities; this may result in overloading the plant. The feasibility, effectiveness, and benefits of chemical and biological treatment processes for treating undiluted thermally conditioned sludge recycle liquors were evaluated. Chemical treatment consisted of hydrated lime addition followed by clarification. Biological treatment was achieved in a high rate activated sludge plant. Biochemical oxygen demand (5 day) averaged 26% for the chemical system and 93% for the biological system. Color was reduced in both systems by at least 90%. On a pollutant removal basis, biological treatment is cost effective. Total annual costs for treatment of recycle liquor generated from thermal conditioning of municipal sludges were: chemical, $0.012/kg; biological, $0.027/kg of sludge. (Moore-SRC)
W81-02506

SALT MARSH CREATION: IMPACT OF SEWAGE,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 5C.
W81-02542

UTILISATION OF SEWAGE SLUDGE ON LAND--THE CADMIUM ANGLE.
For primary bibliographic entry see Field 3C.
W81-02586

SEWAGE SLUDGE HYGIENISATION PLANT SUPPLIES FERTILISER,
Sulzer Bros. Ltd., Winterthur (Switzerland).
For primary bibliographic entry see Field 3C.
W81-02591

CONCENTRATIONS OF HEAVY METALS IN FORTY SEWAGE SLUDGES IN ENGLAND,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
For primary bibliographic entry see Field 5A.
W81-02594

METALS REMOVAL AND RECOVERY FROM MUNICIPAL SLUDGE,
Los Angeles County Sanitation Districts, Whittier. San Jose Creek, Water Quality Lab.
R. L. Jenkins, B. J. Scheybeler, M. L. Smith, R. Baird, and M. P. Lo.
Journal of the Water Pollution Control Federation, Vol 53, No 1, p 25-32, January, 1981. 6 Fig, 7 Tab, 16 Ref.

Descriptors: *Metals, *Sludge treatment, *Acids, *Chelation, Trace elements, Separation techniques, Heavy metals, Sulfuric acid, Neutralization, Lime, Activated sludge, Ultimate disposal, Disposal, Chemical reactions, Chemical degradation, Zinc, Copper, Lead, Iron, Chromium, Cadmium, Nickel, Ethylenediamine tetraacetic acid.

Neither solubilization with sulfuric acid nor chelation with EDTA was an economically feasible method of removing toxic trace metals from sewage sludge prior to ultimate disposal in the ocean, on farmland, or by incineration. Chemical costs were up to $71.66 per metric ton for the acid-lime process, more for EDTA. In addition, the 5 to 10 fold dilution added undesirable amounts of water to the sludge. Lime was used to neutralize the acid and precipitate the metals. Metals were removed to a greater degree from the undigested sludges--primary and waste activated--than from digested sludges--primary and waste activated. In the 1 hour acid treatment, using between half and 2 times the stoichiometric dose, Pb, Cd, and Cu were the most difficult to solubilize. Fe, Cr, Ni, and Zn solubilized more readily. In EDTA treatment Cd and Ni removal were similar to acid treatment; Fe, Cr, and Zn less; and Pb and Cu significantly increased. (Cassar-FRC)
W81-02612

MUNICIPAL WASTE WATER REUTILIZATION ON CULTIVATED SOIL,
Brigham Young Univ., Provo, UT.
R. E. Terry, and R. L. Tate, III.
Journal of the Water Pollution Control Federation, Vol 53, No 1, p 85-88, January, 1981. 7 Tab, 15 Ref.

Descriptors: Ultimate disposal, Disposal, *Waste water disposal, *Nutrients, Grasses, Waste water treatment, Nitrogen compounds, Phosphorus compounds, Nitrates, Phosphates, Crops, Irrigation, Effluents, Everglades, Land application, Soil disposal fields, *Municipal waste water, *Water reuse, Agriculture.

Secondary effluent was effectively renovated in Pahokee muck, the most prevalent soil in the Everglades agricultural area. The optimum conditions for treatment were as follows: effluent application rate, less than 5 cm per week; use of a crop; and water table above 75 cm. Effluent or polishing pond water was applied at rates of 2.5, 5.0, and 7.5 cm per week for 19 weeks in a single application weekly to soil cores 95 cm long. More than 94% of added phosphate was retained by the soil; this was not affected by the loading rate. At 2.5 and 5.0 cm per week loading, 70% of the inorganic nitrogen was retained; 25% at the 7.5 cm per week rate. Comparisons with pond water and deionized water showed similar phosphate removal by the soil

More inorganic nitrogen appeared in the leachate when waste water effluent was applied to soil than when pond water was applied, in spite of the fact that inorganic nitrogen levels in both liquids were similar. (Cassar-FRC)
W81-02619

5F. Water Treatment and Quality Alteration

WATER QUALITY CHANGES DURING DISTRIBUTION,
Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
For primary bibliographic entry see Field 5A.
W81-02444

WATER-RELATED SEDIMENT PROBLEMS,
For primary bibliographic entry see Field 8A.
W81-02515

PRECHLORINATION AND TRIHALOMETHANE FORMATION AT WATER TREATMENT PLANTS,
Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
A. H. Vajdic.
Research Publication No 84, 1980. 16 p, 7 Fig, 1 Tab, 12 Ref.

Descriptors: *Chlorination, Water pollution sources, *Water treatment, *Microbiological studies, *Chlorinated hydrocarbons, Pollutants, Water pollution effects, Drinking water, Hydrocarbons, Pollutant identification, Potable water, Water pollution control, Pollutant identification, Bioindicators, Chemical treatment, Clarification, Water use efficiency, Water quality control, Water quality, Water conditioning.

The effect of removing the prechlorination stage (a stage implicated in the formation of trihalomethanes (THM) in drinking water, but employed by water plants using surface water to control biological growth in settling tanks and filters, to increase coagulation efficiency, and lengthening the water-chlorine contact time, increasing disinfection efficiency) from the treatment process was studied on a plant scale both with respect to the microbiological quality of the produced water and its THM content. THM levels produced at three Metro Toronto water plants were studied with/without prechlorination. With prechlorination, average total THM ranged 10.1-14.9 micrograms/liter, well within the maximum acceptable concentration defined in the Guidelines for Canadian Drinking Water Quality (350 micrograms/liter). Without prechlorination, THM production appeared lower on the average but organisms of sanitary significance regularly reached the final disinfection stage and plankton counts increased in the finished water; problems with plant operation also developed. Prechlorination stage omission should only be considered where properly-designed chlorine contact facilities are available, ensuring adequate retention times during final disinfection. (Zielinski-IPA)
W81-02547

DENITRIFICATION OF WATER FOR HUMAN CONSUMPTION,
Societe Generale d'Epuration et d'Assainissement Degremont, Suresnes (France). Dept. of Physical-Chemical Research.
Y. Richard, A. Leprince, G. Martin, and C. Leblanc.
Progress in Water Technology, Vol 12, p 173-191, 1980. 11 Fig, 5 Tab, 14 Ref.

Descriptors: *Denitrification, *Potable water, *Model studies, Nitrification, *Water treatment, Waste water treatment, Phosphorus, Carbon, Nitrogen, Nitrates, Nitrites, Biological treatment, Sludge, Filters, Consumptive use.

A biological denitrification process for the removal of nitrates in water destined for human use is described. The process uses submerged, upward-flow type anaerobic filters and fixed or expanded beds depending on the rising velocity of the water and the characteristics of the support material. The treatment of nitrogenous pollution in water destined for potable use must apply new removal processes different from those used for the nitrification/denitrification of waste waters. Models are proposed for the specific properties of expanded beds which allow calculation of the maximum denitrification rate and the half-saturation coefficient with respect to phosphorus. During routine operating conditions the removal of nitrates in an expanded bed reactor is controlled by the concentration of the sludge, the concentration of the support material, and the height, fluid velocity and temperature. The denitrification reaction is zero-order with respect to phosphorus, carbon, and nitrogen. (Geiger-FRC)
W81-02563

MICROBIOLOGY OF POTABLE WATER,
Environmental Protection Agency, Dallas, TX.
M. J. Allen.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1807-1812, June, 1980. 55 Ref.

Descriptors: *Microbiology, *Reviews, *Potable water, *Water treatment, Bibliographies, Disinfection, Storage tanks, Water analysis, Water quality control, Organic compounds, Bacteria, Viruses, Microorganisms, Coliforms.

A review of the past year's literature on microbiology of potable water concerns bioindicators used to judge water quality, methods of virological assay, water treatment processes, changes in water treatment processes to accommodate increasing amounts of organic chemicals in source waters, disinfection alternatives (chlorine dioxide, ozone, ultraviolet rays, iodine, and electrolytic cells), water storage tank problems, and disinfection of swimming pool water. (Cassar-FRC)
W81-02608

PROCESS FOR PURIFICATION OF CONTAMINATED WATER,
G. A. Guter.
U.S. Patent No 4,206,048, 7 p, 1 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 995, No 1, p 226-227, June 3, 1980.

Descriptors: *Patents, *Water treatment, *Water purification, Separation techniques, *Reverse osmosis, Membrane processes, Anion exchange, Nitrates, Potable water, Chlorides, Regeneration.

A process removes nitrate ions from a contaminated aqueous feed solution and also chloride ion, by forcing the solution through a reverse osmosis membrane which permits passage of nitrate ions through the membrane and into the product water while rejecting chloride ion and other anions such as sulfate and bicarbonate, and concentrating such anions in the brine waste water. An anion exchange resin bed charged in the chloride form is placed in the product water during the reverse osmosis operation. Reverse osmosis product water containing nitrate is treated by the anion exchange resin bed to remove the nitrate ions and replace them with chloride ions. The resulting product water is essentially free of the nitrate impurity and a concentrated waste brine stream is obtained containing essentially chloride salts. When such anion exchange bed has exhausted the chloride ions and becomes loaded with nitrate ions, the resulting anion exchange resin is placed in the concentrated waste brine stream to regenerate the anion exchange resin with an equivalent amount of chloride ion, liberating the nitrate ion in concentrated form into the waste brine concentrate stream. The same process will remove contaminant ions similar to nitrate such as arsenate, selenate and borate. (Sinha-OEIS)
W81-02626

PACKAGE PLANTS: A COST-EFFECTIVE SOLUTION TO SMALL WATER SYSTEM TREATMENT NEEDS,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 6B.
W81-02632

MECHANISM UNDERLYING THE REMOVAL OF ORGANIC MICROPOLLUTANTS DURING FLOCCULATION BY AN ALUMINUM OR IRON SALT,
Societe Lyonnaise des Eaux et de l'Eclairage (France).
For primary bibliographic entry see Field 5D.
W81-02634

RAW WATER STUDIES DETERMINE SITING OF NEW INTAKE,
Ottawa-Carleton Regional Municipality (Ontario). Works Dept.
B. C. Hutcheon, and D. W. Smith.
Journal of the American Water Works Association, Vol 73, No 1, p 16-23, January, 1981. 3 Fig, 3 Tab, 7 Ref.

Descriptors: *Sampling, *Water quality, Intakes, *Odor, Taste, Runoff, Raw water, Rivers, Frazil ice, Ice, Urbanization, Precipitation, Britannia Plant, Drinking water, *Ottawa, Coliforms, Sites.

The City of Ottawa experienced severe taste and odor problems in drinking water, particularly during spring runoff and after major storms, after construction of the Britannia Plant in 1961. This plant draws its raw water from the Ottawa River. After several attempts to improve water quality by diversion and activated carbon treatment, it was decided to relocate the intake. During a 4-year sampling program, special methods were developed to surmount difficulties from adverse weather, floods, and ice. Sampling stations were installed on the river bottom, and water was conducted to the basement of the plant through plastic hoses. Thus samples were easily available at all times. As a result of the study, the intake was extended 500 feet beyond the original intake. Intake capacity was 96 mgd; diameter, 78 inches. To combat frazil ice, intake bells were made of fiberglass reinforced plastic and the maximum design approach velocity limited to 4.5 inches per second at peak flow. Since these modifications were completed in 1977, no adverse water conditions have resulted from intense storms or spring runoff. (Cassar-FRC)
W81-02635

5G. Water Quality Control

SUPPLEMENTAL REPORT ON PHOSPHORUS MANAGEMENT STRATEGIES.
International Joint Commission-United States and Canada.
Report, January 30, 1981. 24 p, 3 Append.

Descriptors: *Phosphorus, *Nutrients, *Water quality standards, International agreements, *International waters, *Canada, Management planning, Phosphorus compounds, Phosphorus removal, Pollution load, Nutrient requirements, Planning, International commissions, Organizations, Water quality, Water quality control, Water quality management, Water properties, Water pollution control.

The International Joint Commission (IJC) confirmed that the target loads in Annex 3 (given in Appendix B) of the 1978 Great Lakes Water Quality Agreement are the best presently available estimates of maximum annual phosphorus loads that would achieve Agreement goals. Provided the target loads are adopted, the IJC presents a strategy to attain them, primarily an expansion of the strategy that the IJC's Pollution from Land Use Activities Reference Group (PLUARG) found to be most cost effective of the measures studied. IJC notes that other cost-effective strategies to attain target loads may also be possible, and that target loads were based on scientific and technical considerations. Other factors that might be considered in the development of target loads and programs to meet them include projected impacts of current control programs, biological availability, nearshore problems, and socio-economic considerations. The IJC Governments need to confirm target loads by

May 22, 1981. If further consideration of any of these factors is needed, an intensive study program is recommended, together with an interim strategy of phosphorus management. (Zielinski-IPA)
W81-02439

GREAT LAKES SCIENCE ADVISORY BOARD: REPORT OF THE AQUATIC ECOSYSTEM OBJECTIVES COMMITTEE.
International Joint Commission-United States and Canada, Windsor (Ontario).
Report, November, 1980. 127 p, 5 Fig, 17 Tab, 290 Ref.

Descriptors: *International waters, *Great Lakes, International agreements, *Canada, *Water quality standards, Pollutants, Pollution load, Management planning, Planning, International commissions, Water quality, Water quality control, Water quality management, Water pollution control, Halogenated pesticides, Residual chlorine, Cyanide, Trace metals, Nutrients, Water temperature, Nutrient requirements.

The objectives and activities of the Aquatic Ecosystem Objectives Committee (AEOC), with regard to the 1978 Great Lakes Water Quality Agreement (GLWQA), were summarized and discussed. Objectives and supporting rationale for a number of materials and factors related to water quality were reviewed. The AEOC recommended adoption of specific objectives into the 1978 GLWQA. These recommendations included that: a pentachlorophenol aqueous concentration of 0.4 micrograms/liter (mcgs/l) should not be exceeded; 2,3,7,8-tetrachlorodibenzo-para-dioxin (TCDD) should be absent from all ecosystem compartments; water used for body contact recreation activities should be substantially free from bacteria/fungi/viruses that may produce enteric disorders, infections or diseases, and that fecal coliform bacteria levels should not exceed a logarithmic mean of 200 fecal coliforms per 100 milliliters; total lead concentrations in unfiltered water should not exceed 2,3,4, and 5 mcgs/l in Lakes Superior, Huron, Erie (or Michigan), and Ontario, respectively; total residual chlorine should not exceed 2 mcgs/l; total silver and free cyanide in unfiltered water should not exceed 0.1 and 5 mcgs/l, respectively. Recommendations concerning temperature and nutrients were also developed. (Zielinski-IPA)
W81-02440

TREATMENT OF IRRIGATION WATER FOR THE REMOVAL OF FUNGI AND NEMATODES,
South Africa Co-Operation Citrus Exchange, Nelspruit.
A. Hough.
The Citrus and Subtropical Fruit Journal (Johannesburg), No 547, p 20, June, 1979.

Descriptors: *Fungi, *Nematodes, *Water pollution sources, *Irrigation water, *Water treatment, Water purification, Filtration, Water quality, Aquatic fungi, Pathogenic fungi, Soil fungi, Fungicides, Microorganisms, Plant diseases, Spores, Aquatic animals, Aquatic microorganisms, Irrigated land, Irrigation practices, Reservoir operation, Runoff, Chlorination, *South Africa.

Contaminated irrigation water is the major source of infestation of arable soil and disease of crop plants with fungi and nematodes. Irrigation water becomes contaminated from river water derived from heavy rain run-off picking up soil-borne fungal spores and nematodes. Analysis of Crocodile River water near Nelspruit indicated that 500 million Phytophthora spores, 2 billion Pythium spores and 0.5 million citrus nematode larvae are added to one hectare of land for every 100 mm of irrigation water applied. Irrigation water can be improved by storage in dams for a few weeks. Water treatment with a general biocide like chlorine has little effect. Ultraviolet irradiation is also of little help when water quality is not high. Preliminary filtration is usually used prior to such treatments. Flocculation with aluminum sulfate and Floccutan and sand filtration can be used, or alternately, water can be pumped downwards through a series of graded sand filters, but free-swimming spores are not retained. Further filtration through a cartridge filter coated with diatomaceous earth or powdered vermisculite is required. Exposure of spores to one part-per-million free available chlorine for ten minutes is then required for final water sterilization. (Zielinski-IPA)
W81-02443

EFFECTS OF STRIP MINING THE ABANDONED DEEP ANNA S MINE ON THE HYDROLOGY OF BABB CREEK, TIOGA COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-02447

PROTEIN AND NITRATE CONTENT OF LEMNA SP. AS A FUNCTION OF DEVELOPMENTAL STAGE AND INCUBATION TEMPERATURE,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 2I.
W81-02497

TECHNIQUES FOR CREATING SALT MARSHES ALONG THE EAST COAST,
North Carolina State Univ. at Raleigh.
E. D. Seneca.
In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, Georgia, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC., Report FWS/OBS-80/27, November, 1980, p 1-5. 4 Ref.

Descriptors: *Vegetation establishment, *Marsh management, *Salt marshes, *North Carolina, Marsh plants, Dredging, Spoil banks, Estuarine environment, Salinity, Shoreline cover, Coasts.

Open water disposal of dredge material was previously carried out in North Carolina. In an effort to stabilize the intertidal zone of this dredge material by the establishment of salt marshes, smooth cordgrass was transplanted or seeded into areas of dredge spoil along the coast. Two full above-ground growing seasons or about 17 months are required for transplants to develop the root and rhizome network that binds the substrate together. Transplants can be dug at about 150 to 200 transplants per man-hour and planted at the same rate with persons working in a two-man team. Transplants can be obtained about twice as rapidly with mechanical equipment. Seeds can be stored in either instant ocean or estuarine water at about 2 to 4C. Direct seeding is feasible only in the upper half of the intertidal zone. For smooth cordgrass to maintain itself, salinities around 20 ppt are necessary; for salinities of 5 to 10 ppt, smooth cordgrass will not remain dominant more than 3 or 4 years. The marsh will then be invaded by other species, which is not necessarily bad because neither substrate stabilization nor marsh creation is lost. In stabilizing estuarine shorelines, vegetation is in certain situations a logical alternative to man-made structures. (Moore-SRC)
W81-02530

CREATION OF A SOUTHEASTERN UNITED STATES SALT MARSH ON DREDGED MATERIAL,
Georgia Dept. of Natural Resources, Brunswick. Coastal Resources Div.
R. J. Reimold.
In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, Georgia, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC., Report FWS/OBS-80/27, November, 1980, p 6-22. 10 Fig, 4 Tab.

Descriptors: *Marsh management, *Salt marshes, *Marsh plants, *Vegetation establishment, Spoil banks, Estuarine environment, *Georgia, Dredging, Water chemistry, Nitrogen, Phosphorus, Fertilization, Coasts.

Often it may be necessary to supplement the nutrient content of soils with commercial fertilized applications so that marsh plants can become successfully established. Marsh plant, soil interactions were evaluated in terms of carbon, nitrogen, and phosphorus levels to gain information about nutrient uptake by marsh plants and to determine marsh plant response to fertilizer application. The site used for these studies was Buttermilk Sound, Georgia, which had been used for disposal of dredged material. Amounts of nitrogen and phosphorus in the water column appear to follow the typical estuarine pattern of high concentrations in winter and low concentrations in summer. There has been no evidence of eutrophication from the fertilizer added to the test plots. Sprigs of seven plants commonly found in natural marshes near the study site were transplanted during June 1975 to the research plot. At destructive sampling in November 1975, sprig height, culm density, aerial biomass, and below ground biomass of macroorganic material were determined and compared with the same parameters at transplantation. All seven of the plants showed an increase in sprig height, aerial biomass, and below ground biomass: all except Iva frutescens showed an increase in culm density. The greatest increase in culm density was found in Spartina patens, from 10/square m to 321.5/square m. (Moore-SRC)
W81-02531

TECHNIQUES FOR CREATING SALT MARSHES ALONG THE CALIFORNIA COAST,
H. L. Mason.
In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, Georgia, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC., Report FWS/OBS-80/27, November, 1980, p 23-24.

Descriptors: *Salt marshes, *Marsh management, *Spartina, *Vegetation establishment, Dredging, Spoil banks, Coasts, Wetlands, Marsh plants, *California.

Spartina seed may be difficult to find on the West Coast; a good way to locate Spartina seed is to look for a patch that is infested with ergot because there has to be an embryo present before the ergot becomes established. A team of two men in a boat can harvest seed by one using a pole to push the plant over the boat while the second man snips off the seed heads with hedge pruning shears. In two days two men harvested enough seed to fill three 55-gallon drums. Seed can be stored in water under refrigeration. Some seed germinates while under storage. Cuttings from the rhizomes and fall buds both proved satisfactory for planting. Spoil banks can be planted and fertilized. The first year the plants did not grow much, but the second year they were growing fairly well, and by the third year some single bud cuttings had 15 shoots coming up. The best area for planting was in the lower tidal area. Establishment was very good beyond the area of the low-low tide and high-low tide. (Moore-SRC)
W81-02532

SALT MARSH CREATION IN THE PACIFIC NORTHWEST: CRITERIA, PLANTING TECHNIQUES, AND COSTS,
Wave Beach Grass Nursery, Florence, OR.
W. E. Ternyik.
In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, Georgia, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC., Report FWS/OBS-80/27, November 1980, p 25-27. 1 Tab.

Descriptors: *Marsh management, *Salt marshes, *Marsh plants, *Vegetation establishment, *Oregon, Estuarine environment, Coasts, Dredging, Wetlands, Spoil banks.

Pilot test planting of six species of vascular plants endemic to the area was carried out at Mill Sands, Oregon on dredged material. Species selected for planting were Eleocharis palustris, Junc

balticus, J. effusus, Scirpus validus, Carex lyngbyei, and Deschampsia caespitosa. Plants were selected as near to the early growth stage as possible to avoid possible shock. Sites for plant collection were selected based on quality and vigor of plants, state of growth, site location, plant age, quantity of plant stock, and similarity to the test plot. All plants were hand dug, cleaned and divided. The initial storage method was to heel-in prepared plants in sandy intertidal areas, but this method was quickly discarded when it was found that the plants were so firmly settled after one tide that major damage occurred in removal. The second method was storage in plastic containers in the intertidal marsh areas. Some plants were stored up to 5 days without any problems. No site preparation was necessary, because of the even, flat terrain and uniform sand material. Fertilized plots all received a single application of 11-55-0 pelleted fertilizer. The growing season was followed from June 1975 to November 1975. Cost estimates for large scale plantings can be developed after two more years. (Moore-SRC)
W81-02533

SALT MARSH SOIL DEVELOPMENT,
Delaware Univ., Lewes. Coll. of Marine Studies.
J. L. Gallagher.
In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, Georgia, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC., Report FWS/OBS-80/27, November, 1980, p 28-34. 3 Tab, 10 Ref.

Descriptors: *Salt marshes, *Marsh management, *Soil formation, Marsh plants, Vegetation establishment, Nutrients, Soil management, Salinity, Soil chemistry, Soil physical properties, Coasts, Wetlands.

Salt marsh creation may be considered to be basically a problem of developing salt marsh soils from marine sediments. Sediments from which natural marshes develop are tidally deposited, resulting in rather uniform grain size fractionation. Dredging is the usual method of deposition of sediments for marshes created artificially on the coast. This technique leads to complex and variable parent material, making the establishment of proper conditions for plant growth difficult. Most marsh soils are either Histosols or Entisols. The problems associated with the development of salt marsh soils from marine sediments include: stability, acidity, moisture, salinity, and nutrients. There are certain plants, occurring in the natural marsh, that have characteristics which may make them useful in facilitating certain desired changes in the substrate. Sporobolus virginicus, Distichlis spicata, and Salicornia virginica are tolerant of a wide range of salinities, while Spartina patens is adaptable to growth in the upper marsh and drier areas. The depth of roots may be important for stabilizing soils of for preventing roots from penetrating a soil zone which is inhospitable or may contain a contaminant that could be translocated to aerial food webs. (Moore-SRC)
W81-02534

SALT MARSH SUBSTRATE INTERACTION: MICROORGANISMS,
Skidaway Inst. of Oceanography, Savannah, GA.
R. B. Hanson.
In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, Georgia, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC., Report FWS/OBS-80/27, November, 1980, p 35-52. 12 Fig, 2 Tab, 10 Ref.

Descriptors: *Salt marshes, *Microorganisms, *Substrates, *Marsh plants, *Georgia, Estuarine environment, Coasts, Dredging, Ecosystem, Aquatic habitats, Algae, Yeasts, Bacteria, Cycling nutrients, Protozoa, Invertebrates, Buttermilk Sound.

Information on microbial development is needed so that comprehensive guidelines can be formulated for coastal ecosystem habitat development. Microbial colonization in dredge materials planted with marsh plants was investigated at Buttermilk Sound, Georgia. From January to July, the concentration of ATP increased in the surface stratum but ATP concentrations remained unchanged in the 5 to 7 cm and 10 to 12 cm strata. The decrease in ATP biomass with depth suggests that the carbon input is from the surface, and the source of carbon may be from the detrital and algal carbon deposited on the surface. In the surface stratum, the bacterial populations were generally greater than 500,000 colony forming units per gram dry weight. The populations were generally an order of magnitude lower in the substrata than in the surface stratum. The medium to coarse sands at the dredged site may account for the low population density. The yeast population decreased with depth similar to the bacterial populations and ATP concentrations. The diversity of the benthic algal community increased between January and September. Protozoans and meiofauna were found in most sediments, and the fauna were more abundant toward the end of the summer. Based on available information, nutrient regeneration by microbenthos and macrobenthos, and tidal input of detritus play an essential role in coastal ecosystem development. (Moore-SRC)
W81-02535

MANGROVE SWAMP CREATION,
Miami Univ., Coral Gables, FL. Dept. of Biology.
H. J. Teas.
In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, Georgia, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC., Report FWS/OBS-80/27, November, 1980, p 63-90. 21 Fig, 39 Ref.

Descriptors: *Mangrove swamps, *Vegetation establishment, *Management, Wetlands, Brackish water, Estuarine environment, Salinity, Coasts, Tidal effects, Light intensity, Wave action, Sediment erosion, Stabilization, *Florida.

A mangrove swamp is a complex ecosystem. Although the species of plants are relatively few, the animals are numerous and diverse. The goal of a mangrove planting or replanting program should be the development of a functional, diverse ecosystem. Mangroves require open sunlight for optimal growth. The light intensity at ground level under a full canopy of mangrove forest may only be 5% to 10% of the open sun values, which is less than seedlings require. Another factor in mangrove establishment is tidal depth. Mangroves do not become established at substrate elevations substantially below mean sea level, and decreased tidal flushing may kill mangroves, especially red mangroves. Mangroves tolerate, but do not require saltwater. Mangroves may grow larger in the zone of lower, fluctuating salinities some distance into an estuary from the shore than they do in saline waters near the shore. Shoreline energy from natural waves, currents, and boat wakes can wash out or topple mangroves. The relatively greater resistance to wave erosion of the root systems of the black and white mangroves in comparison with red mangroves is an important factor in shoreline stabilization and mangrove swamp creation. Another enemy of mangrove seedling establishment is floating trash that can cover, uproot, or break off seedlings. Some soils, such as broken coral and nutrient deficient leached soils, provide poor substrates for mangrove development. Root parasites, fungus diseases, and damage by the public also may effect mangrove seedling establishment. (Moore-SRC)
W81-02536

COASTAL HABITAT DEVELOPMENT IN THE DREDGED MATERIAL RESEARCH PROGRAM,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 6G.
W81-02537

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

A PROCESS FOR COMMUNITY FLOOD PLAIN MANAGEMENT, SUMMARY REPORT.
Leman Powell Associates, Inc., Alexandria, VA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185282, Price codes: A03 in paper copy, A01 in microfiche. Office of Water Research and Technology Report OWRT TT/80 1 April, 1980. 22 p, 6 Fig, 1 Tab. OWRT-C-90066-T(No 9616)(1).

Descriptors: *Flood plains, *Flood protection, *Water management(Applied), *Planning, *Flood control, Civil engineering, Flood damage, Flood flow, Personnel, Warning systems, Flood routing, Flow, Forecasting, Peak discharge, Floods, Hydrology, Runoff, Floodplain zoning, Floodways, Discharge(Water), Flow control.

This summary report calls attention to promising methods for managing flood plains, and was derived from a more extensive Office of Water Research and Technology planning manual (A Process for Community Flood Plain Management) which details the concepts of flood plain management to assist a community to develop sound programs. Flood plain management involves the analysis and integration of measures used to prevent/mitigate flood damage in a given location to protect and preserve natural/environmental/historical/cultural values of the plain; employment of trained staff; and an understanding of the nature of floods, their expected frequency, and their impact on the land under consideration. Flood hazard potential must be assessed relative to available physical data, the economic role of the flood plain, and social impacts of flooding, among others. Management approaches include reducing flooding susceptibility, flood modification, and flood impact modification. Pertinent Federal law related to flood plain management is summarized, as well as available sources of assistance to communities. Finally, the features of the flood plain management process as a continuing program are delineated. (Zielinski-IPA)
W81-02420

DEVELOPMENT OF A DIGITAL MODEL OF GROUNDWATER FLOW IN DEEPLY WEATHERED CRYSTALLINE ROCK, CHESTER COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02446

APPRAISAL OF POTENTIAL FOR INJECTION-WELL RECHARGE OF THE HUECO BOLSON WITH TREATED SEWAGE EFFLUENT--PRELIMINARY STUDY OF THE NORTHEAST EL PASO AREA, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-02458

THREE-DIMENSIONAL DIGITAL-COMPUTER MODEL OF THE FERRON SANDSTONE AQUIFER NEAR EMERY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02481

COMPUTER PROGRAM FOR NETWORK ANALYSIS FOR REGIONAL INFORMATION,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W81-02483

Group 6A—Techniques Of Planning

GROUNDWATER OF COAL DEPOSITS, BAY COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-02486

AUTOMATIC COMPUTERIZED COMPUTATION OF AN OPTIMAL SEWERAGE NETWORK BY DYNAMIC PROGRAMMING,
Tahal Consulting Engineers Ltd., Tel Aviv (Israel).
E. Kally.
Water Services, Vol 84, No 1018, p 723-725, December, 1980. 3 Fig, 2 Tab, 3 Ref.

Descriptors: *Computers, *Sewage, *Cost analysis, Optimization, Programs, Planning, Data processing, Project planning, Estimated costs.

Computer design of a sewage system produced an optimum system at 10% lower cost than a manually calculated method. Other advantages were: all requirements were met (maximum and minimum streamflow velocities, maximum and minimum ratio of depth of water flowing in pipe to pipe diameter, minimum pipe slope, maximum and minimum excavation depth), human errors were eliminated, and results were presented in a clear and complete printout. The network was made of sections of pipes stretching between manholes in a loopless format, and used gravitational flow. (Cassar-FRC)
W81-02588

A USABLE INPUT-OUTPUT FLOW CHART OF A MUNICIPAL WATER SYSTEM,
Consoer Townsend Harris International, Inc., San Juan (Puerto Rico).
V. Bengoechea, D. W. Hendricks, and R. E. Krempel.
Journal of the American Water Works Association, Vol 73, No 1, p 3-8, January, 1981. 3 Fig, 3 Tab, 3 Ref.

Descriptors: *Systems analysis, *Input-output analysis, *Water distribution, Distribution, Water supply, *Fort Collins, Colorado, Planning, Decision making, Management, Municipal water.

An input-output water transactions table is a systems analysis tool useful for understanding and communicating the many interacting components in a municipal water system. An example featuring the Fort Collins, Colorado, water system is presented. The matrix contains 65 outputs (10 entries and 55 internal components) and 68 inputs (13 exits and 55 internal components), 200 water transfers, and 133 totals of water distributed to and from various components. Typical entries are river flow, reservoir storage, and infiltration of groundwater into the sewer system. Typical exits are groundwater, the atmosphere, and water sold to other distribution systems. Internal components may be raw water, treatment plants, distribution systems, users, and sewage treatment plants. All this information is displayed on an 8 feet square color-coded magnetic board. One inch squares are labeled with different colored magnetic strips. Information may be moved around and changed easily. The mass balance principle is applied. That is, the total system input = total output. For internal components the sum of inputs = sum of outputs. (Cassar-FRC)
W81-02636

6B. Evaluation Process

IMPACT OF AVAILABILITY OF WATER AND COST OF ENERGY INPUTS ON AGRICULTURAL PRODUCTION IN THE OKLAHOMA PANHANDLE,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W81-02410

WATER RESOURCES PROBLEMS AND RESEARCH NEEDS, NEW YORK STATE, 1982-1987.
Cornell Univ., Ithaca, NY. Center for Environmental Research.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185357, Price codes: A07 in paper copy, A01 in microfiche. Report, October, 1980. 133 p, 24 Fig, 11 Tab, 54 Ref, 1 Append.

Descriptors: *Research priorities, *New York, *Planning, *Research and development, *Water resources development, Water resources hazards, Poisons, Safety, Federal Government, Management, Institutions, Project planning, Water quality, Water pollution, Water pollution sources, Water pollution treatment, Chemical wastes, Effluents.

Most of New York State water is derived from surface waters, mostly for electric utilities/industries use with relatively small use for public supplies; while groundwater uses are proportionately higher for public and rural private uses. Water problems have been identified in four areas: water quantity (urban water systems deterioration; expansion; inadequate management); water quality (groundwater contamination; hazardous wastes; non-point source pollution and eutrophication); flooding (inadequate floodplain management and flood warning/emergency measures); and environmental impacts (wet lands degradation/elimination; stream quality/quantity and coastal zone deterioration). Identified research needs were classified into critical, urgent, or important priority categories. Critical priorities included: (1) land use versus contaminant production and movement to the water table; (2) interaction of potential contaminants and acid precipitation with ecosystems; (3) hazardous wastes health/economic impacts; (4) potential synergistic effects of hazardous chemicals in waters; (5) use of hydrologic and water quality models to enhance planning, and detection/monitoring systems for hazardous waste; and (6) improved data on hazardous waste production/location/chemical composition. (Zielinski-IPA)
W81-02411

POLICY ANALYSIS OF RESERVOIR OPERATION IN THE POTOMAC RIVER BASIN, VOLUME I, EXECUTIVE SUMMARY,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
R. N. Palmer, J. R. Wright, J. A. Smith, J. L. Cohon, and C. S. ReVelle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185407, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, (1980). Maryland Water Resources Research Center, University of Maryland, College Park, Technical Report No 59. 30 p, 4 Fig, 2 Tab. OWRT-B-027-MD(3), 14-34-0001-8089.

Descriptors: *Policy making, Decision making, Optimization, *Reservoir operation, River basins, *Computer models, Administrative decisions, Systems analysis, Optimum development, *Simulation analysis, Plans, Planning, Resources development, Reservoir storage, Reservoirs, Mathematical studies, Simulation, Model studies, Evaluation, Estimating, Prediction, *Potomac River basin.

The first volume of the final report of the project study on policy analysis of Potomac River Basin reservoir operation represents a summary of those models and project study results and water supply management in the Washington, D.C. Metropolitan area discussed in detail in Volumes II and III. Purposes and assumptions of the models and the major results are emphasized. The first year of the two-year study (1977-79) concerned formulation and solution of optimization models for determining Washington water supply system limits, and for explaining tradeoffs between conflicting water uses. With optimal and prescient reservoir operation, the water supply system yield is significantly higher and useful life substantially longer than previously thought. Upstream demands and Washington area water supply are in conflict in subtle ways, but not to the same degree over all values upstream demand. The second year project focus was on development of the Potomac River Interactive Simulation Model (PRISM), a policy tool found more valuable than optimization models. The Low Flow Allocation Agreement, a unique low flow compact for Washington water management was included in PRISM. Experience with PRISM indicated planners and decision makers have learned about Washington water supply management from PRISM sessions. (Zielinski-IPA)
W81-02413

POLICY ANALYSIS OF RESERVOIR OPERATION IN THE POTOMAC RIVER BASIN, VOLUME II, LIMITS OF THE WASHINGTON METROPOLITAN WATER SUPPLY SYSTEM,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
R. N. Palmer, J. R. Wright, J. A. Smith, J. L. Cohon, and C. S. ReVelle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185415, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, (1980). Maryland Water Resources Research Center, University of Maryland, College Park, Technical Report No 59. 132 p, 16 Fig, 47 Tab, 81 Ref, 3 Append. OWRT-B-027-MD(3), 14-34-0001-8089.

Descriptors: Decision making, *Computer models, River basins, *Policy making, *Simulation analysis, *Reservoir operation, Optimization, Administrative decision, Systems analysis, Optimum development plans, Resources development, Planning, Reservoirs, Reservoir storage, Mathematical studies, Prediction, Model studies, Simulation, Evaluation, Estimating, *Potomac River basin.

The focus of the volume is on mathematical programming models and their use in generating information about important tradeoffs in water allocation. The study examined the limits of the water supply system serving the Washington (D.C.) Metropolitan Area (WMA), and the potential yield of each individual reservoir that contributes to WMA's water supply was investigated. The theoretical limit of conjunctive operation of all reservoirs in meeting constant demand was determined using a Hypothetical Reservoir Operation procedure, while practical yield of that system was determined by an Optimal Integration Procedure. This Procedure was applied to the more complex system of the reservoirs, plus the largely unregulated Potomac River, with the resulting establishment of a series of monthly operating rules for the reservoir system. Further, a Linear-System Yield Determination formulation was developed to establish system yield for certain capacity and operating constraints. Monthly demand functions were incorporated with constraints reflecting current and future conditions. System yields obtained by exploration of different scenarios allowed for determination of attainable operating goals for the WMA water supply system. The interactive PRISM model, incorporating low river flows, is described in Volume III. (Zielinski-IPA)
W81-02414

POLICY ANALYSIS OF RESERVOIR OPERATION IN THE POTOMAC RIVER BASIN, VOLUME III, POTOMAC RIVER INTERACTIVE SIMULATION MODEL,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
R. N. Palmer, J. R. Wright, J. A. Smith, J. L. Cohon, and C. S. ReVelle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185423, Price codes: A09 in paper copy, A01 in microfiche. Completion Report, (1980). Maryland Water Resources Research Center, University of Maryland, College Park, Technical Report No 59. 181 p, 50 Fig, 27 Tab, 13 Ref, 3 Append. OWRT-B-027-MD(3), 14-34-0001-8089.

Descriptors: *Computer models, *Simulation analysis, *Policy making, River basins, Decision making, *Reservoir operation, Optimization, Optimum development plans, Systems analysis, Administrative decisions, Reservoir storage, Resources development, Planning, Model studies, Prediction, Estimating, Evaluation, Simulation, Mathematical studies, Reservoirs, *Potomac River basin.

The final volume of the report describes development of the Potomac River Interactive Simulation Model (PRISM), a policy tool which is both more realistic than optimization models (Volume II) in its representation of the Potomac Basin and the Washington Metropolitan Area (WMA) water supply system, and potentially more useful to planners and decision makers. Because certain constraint inputs to linear programming modeling (Volume II) was not possible, another model (PRISM) of the WMA water supply was developed. PRISM, a descriptive model, illustrates what would result from a given operating policy. PRISM is designed to simulate potential reservoir operation and water supply management policies during periods of drought. Inflows, storages, and releases of the upstream reservoirs were calculated weekly and their impact on water available to the WMA evaluated. Downstream reservoir operation was simulated weekly, together with average monthly regional water demands. From these factors, potential deficits in water availability for each region were calculated. Where Corps of Engineers planning assumptions forecast no supply problems in the year 2005, use of historic flows forecast that up to 18 weeks of deficit would occur; PRISM analysis showed these anticipated deficits to be due more to inflexible operating policy than to water storage shortage. (Zielinski-IPA)
W81-02415

OPTIMAL EXPANSION OF A WATER RESOURCE SYSTEM AND ISSUES OF WATER ALLOCATION AND UTILIZATION: UMATILLA RIVER BASIN, OREGON,
Oregon State Univ., Corvallis.
B. H. Lin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185316, Price codes: A09 in paper copy, A01 in microfiche. Master of Science Thesis, June, 1981. 166 p, 10 Fig, 28 Tab, 56 Ref, 5 Append. OWRT-A-046-ORE(1).

Descriptors: *Water resources development, *Oregon, *River basin development, *Model studies, *Optimization, Water allocation, Resources development, Water supply development, Computer, Models, Systems analysis, Resource allocation, Water use, Estimated benefits, Evaluation, Economic aspects, Agriculture, Fisheries, Irrigation, *Umatilla River basin.

This study explored the merits of scheduling water resource project facilities on the basis of the anticipated economic benefits provided. Using the Umatilla River Basin in northeast Oregon as a case study example, the facilities (and their alternatives) of a previously-planned Federal water resource development project in that area were analyzed relative to the magnitude and timing of anticipated costs and benefits, focusing on irrigated agriculture and fishery development/enhancement benefits. A basic scheduling model was designed, aimed at maximizing the present value of net benefits (PVNB) inherent in an optimally-timed set of facilities subject to an annual budget constraint. It was found that the PVNB of the project could be significantly enhanced when compared to the original schedule proposed in the project planning documents. Incorporation of considerations of tradeoffs/exchanges between project beneficiaries into the capacity expansion mode of the planning process was of even greater interest. These interrelationships were explored with special attention to the manner in which water exchanges (via water rights transfers) could establish higher benefit levels in future years. (Zielinski-IPA)
W81-02416

CONFLICTS OVER THE COLUMBIA RIVER, SEMINAR CONDUCTED BY WATER RESOURCES RESEARCH INSTITUTE, OREGON STATE UNIVERSITY, SPRING QUARTER 1980.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185191, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute, Oregon State Univ., Corvallis. Report SEMIN WR 028-80, July, 1980. 107 p, 10 Fig, 9 Tab, 42 Ref. OWRT-A-999-ORE(26).

Descriptors: *Columbia River, *Oregon, *Fish management, *Water policy, *International waters, Water quality, Planning, Drainage systems, Estuaries, Riverflow, River systems, Hydroelectric power, Treaties, Water quality control, Water utilization, Water sources, Water supply, Alternative water use, Recreation, Riparian rights, Reasonable use.

A recent report of the Pacific Northwest River Basins Commission discussed the Columbia River characteristics. Some of the factors involved were presented in this Seminar, covering: River uses; concern over the Columbia estuary; fish management and protection; River protein/power/preservation/politics; Indian fishing; costs/benefits/trade-offs of agriculture and hydro-power; River water quality; international management; and navigation. In terms of river use, the main stem of the Columbia is essentially fully developed. However, there is much work to be done on the tributaries, and the key to tributary development is upstream storage. The Columbia River Estuary Data Development Program was described in terms of its functions and products. The early 1980's will be a transition period for salmon/steelhead; accomplishments in river management/protection during the next five years will be critical to survival of upriver runs. Under the Treaty agreement with Canada, both nations have derived substantial electrical energy at markedly less cost than had alternative sources been developed independently; this is also true for flood hazard mitigation. Commercial navigation must be considered along with other Columbia Basin water uses in the policy-making process. (Zielinski-IPA)
W81-02418

A BUILDER'S GUIDE TO WATER AND ENERGY,
Alaska Univ., Fairbanks. Inst. of Water Resources.
R. D. Seifert, and L. P. Dwight.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185217, Price codes: A05 in paper copy, A01 in microfiche. Report IWR-100, August, 1980. 78 p, 8 Fig, 10 Tab, 28 Ref, 4 Append. OWRT-A-065-ALAS(2).

Descriptors: *Alaska, Building codes, *Urbanization, *Design criteria, *Planning, *Water utilization, Optimum development plans, Energy dissipation, Construction, Construction materials, Design standards, Fabrication, Structures, Water demand, Efficiencies, Energy loss, Energy conservation, City planning, Suburban studies, Cities, Human population, Economics.

This Guide was designed to aid those who are developing or improving a piece of property in Alaska. It will also be useful to those considering investing in Alaskan property, especially those building in urban/suburban areas. Information on water and energy, while theoretically available to the Alaskan home builder and property developer, has been difficult to glean from the widely diverse sources. The Guide discusses this variety of planning considerations - ranging from the selecting of a lot to the fine points of energy conservation - in the chronological order needed by the builder. Topics include selecting the actual building site, water access, sewage disposal, energy access, energy conservation, tax credits, and government regulations. The Guide provides step-by-step assistance for developing a site and building upon it, while taking maximum advantage of a site's best characteristics and minimizing its shortcomings. (Zielinski-IPA)
W81-02422

AGRICULTURAL WATER DEMAND PREDICTION USING REMOTE SENSING TECHNOLOGY FOR GEORGIA RESOURCE MANAGEMENT,
Georgia Univ., Athens. Dept. of Geography.
J. R. Jensen, and D. L. Chery.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-184137, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, December, 1980. Environmental Resources Center, Georgia Institute of Technology, Atlanta, Report ERC 07-80. 47 p, 15 Fig, 2 Tab, 54 Ref, 1 Append. OWRT-A-083-GA(1).

Descriptors: *Water demand, Agriculture, *Remote sensing, *Prediction, *Irrigation requirements, *Georgia, Computer models, Hydrologic budget, *Evapotranspiration, Agricultural watersheds, Watersheds, Irrigation practices, Irrigation efficiency, Sensors, Resources management, Water management, Evapotranspiration potential, Hydrologic aspects, Hydrologic models, Hydrologic equation, Hydrologic data.

In many areas of well water irrigation, an expedient and simple method is needed for assessing the amount of water pumped from aquifers or the effect of intensive agriculture on watershed water balance (WWB). Certain measurements are needed to model WWB, with the major flow components being (1) rainfall input, and (2) outflows of evapotranspiration (ET) and surface and subsurface discharge. ET was determined by careful selection and analysis of Landsat digital data to determine an agricultural region's land cover; ET was then used in a hydrologic water balance model. Digital image processing of Landsat-3 data discriminated major field crops and forests in Tift County, Georgia, for a water use assessment. A water balance model based on a modified Penman relationship was developed to estimate ET. The remotely-sensed data and local meteorological data were then used in a hydrologic model to predict daily WWB. The simulation was evaluated by comparing model performance with WWB measurements for a 15.5 square-kilometer instrumented agricultural watershed. (Zielinski-IPA)
W81-02428

WATER, ENERGY, AND ECONOMIC DEVELOPMENT TOWARDS AN INTEGRATED REGIONAL POLICY ANALYSIS SYSTEM,
Rhode Island Univ., Kingston.
R. W. Hardy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-184111, Price codes: A04 in paper copy, A01 in microfiche. New England Council of Water Center Directors Completion Report, February, 1981. 51 p, 3 Fig, 1 Tab. OWRT-C-90071-G/C-00191-G(No 9412)(1).

Descriptors: *Water policy, *Water resources development, *Institutions, *Governmental interrelations, *Regional analysis, Institutional constraints, Planning, Projections, Estimated costs, Economic efficiency, Financial feasibility, Legislation, Natural resources, Political aspects, Political constraints, Analysis, Cost analysis, Governments, Constraints, Administration, Computer models, Research and Development.

The first version of the study prospectus for this project was developed in 1972. The general study thesis was that water resources development and preservation, as well as energy production and consumption, have common links in economic development; and that, thus, policy analysts could use an integrated methodological approach. It was concluded that the nature of institutions and how they function seems to require highly compartmentalized decision-making/planning, and incentives for coordination appear weak. The implications of this conclusion were explored, and potential solutions were sought. Regional policy analysis should include several principal components, one of which should be the use of a computer model or set of linked models or technical tool for regional interaction analysis, capable of tracing the path/magnitude/speed/sequence of expected water/energy/economic development interactions. Research needs have been identified. It was felt that universities are the most appropriate institutions for conducting policy-oriented regional team research. (Zielinski-IPA)
W81-02430

WATER, ENERGY, AND ECONOMIC DEVELOPMENT TOWARDS AN INTEGRATED REGIONAL POLICY ANALYSIS SYSTEM, SELECTED BACKGROUND ESSAYS.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-184129, Price codes: A03 in paper copy, A01 in microfiche. New England Council of Water Center Directors Completion Report, December, 1980. Hardy, R.W., Ed. 41 p, 2 Fig, 52 Ref. OWRT-C-90071-G/C-00191-G(No 9412)(3), 14-34-0001-9412.

Descriptors: *Water policy, *Water resources development, *Governmental interrelations, *Regional analysis, *Computer models, Institutional constraints, Planning, Projections, Estimated costs, Economic efficiency, Financial feasibility, Legislation, Research and Development, Natural resources, Political aspects, Political constraints, Analysis, Cost analysis, Governments, Administration.

This report, based on a selected literature review, consists of brief background essays prepared for the project: 'Water, Energy, and Economic Development Towards an Integrated Regional Policy Analysis System'. Also included is a write-up for a preliminary systems dynamic model, used as a learning tool by members of the project research team. The model was prepared by Dartmouth College. The working papers have been published to elaborate on the thinking behind the main project report (see W81-02430) and to provide a stimulus basis for further research. The working papers have addressed (1) planning theory; (2) institutional impacts of energy systems (the problem of scale); (3) regional incidence of investment and welfare; (4) innovation in the public sector; and (5) description of a preliminary model for the study of interactions among water, energy, and economic development. (Zielinski-IPA)
W81-02431

A METHODOLOGY FOR ASSESSING THE REGIONAL INTER-RELATIONSHIPS OF WATER RESOURCES, ENERGY SUPPLY AND ECONOMIC DEVELOPMENT.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-184145, Price codes: A11 in paper copy, A01 in microfiche. Proceedings of the Workshop, October 4-5, 1979, Boston, Massachusetts. New England Council of Water Center Directors, Water/Energy/Economic Development Project, March, 1980. 195 p. OWRT-C-90071-G/C-00191-G(No 9412)(2), 14-34-0001-9412.

Descriptors: *Research priorities, *Regional development, *New England, *Projections, *Computer models, Planning, Economic prediction, Estimated costs, Multiple-purpose projects, Constraints, Institutional constraints, Legal aspects, Administration, Government, Institutions, Political constraints, Water policy, Project planning, Economic justification, Methodology, Decision making, Forecasting, Water resources development.

This workshop was designed to fulfill in part, specific objectives of the first phase of a research program begun in May 1979 by the New England Council of Water Center Directors to develop an integrated planning method to analyze the dynamic relationship between water, energy, and economic patterns in New England. Five issue papers were presented. The first four reviewed existing methodologies for projecting water and energy demands, electrical energy supply, and economic development patterns; the fifth paper linked the concepts to establish a provisional framework for understanding the basic relationships in the energy/water/economic development system. Discussion of an enlarged view for planning methodology identified a strategy based on (1) a broader understanding of the dynamic behavior of the interrelationships, (2) a greater awareness of institutional structure and changing patterns of public decision-making in a region, and (3) improved guidelines to link (1) and (2). Reports of the three workgroups (regional development dynamics; patterns of decision/institutions; planning strategies/methodologies) are summarized. The overall workshop conclusion was that a more basic understanding of regional economy-energy-water linkages is necessary as a principal first step in planning methodology development. Needed research areas were identified and enumerated. (See W81-02433 thru W81-02437)
W81-02432

ANALYSIS OF SELECTED REGIONAL FORECASTS AND PROJECTIONS OF WATER DEMAND, WATER QUALITY, AND WATER SUPPLY COSTS IN NEW ENGLAND,
Thayer School of Engineering, Hanover, NH.
P. H. Kirshen.
In: A Methodology for Assessing the Regional Interrelationships of Water Resources, Energy Supply and Economic Development, Proceedings of the Workshop October 4-5, 1979, Boston, Massachusetts, p A1-A44, March, 1980. 6 Fig, 3 Tab, 17 Ref.

Descriptors: Forecasting, *Projections, *Water demand, *Water quality, Water supply, Research priorities, *New England, Analysis, Regional development, Planning, *Economic prediction, Estimated costs, Multiple-purpose projects, Constraints, Institutional constraints, Legal aspects, Governments, Administration, Water policy, Project planning, Economic justification, Methodology, Computer models, Decision making.

A research project is currently being coordinated by the New England Council of Water Center Directors to develop a basic methodology for evaluating and predicting the likely regional consequences of public policy decisions in water resources, energy, and economic development. This report is an analysis of projections for water supply (WS), water quality (WQ), and water supply costs (WSC) in New England. Fifteen studies reported over 1968-1977 in the New England area (WS, 8; WQ, 5; WSC, 2) were reviewed and summarized, including their projection methodologies and associated assumptions. A diagrammatic explanation of the qualitative relationships between water, energy, and economic development was developed (causal loop diagram), which shows how factors influence each other (to increase, decrease, or lead to equilibrium) over time. The studies reviewed in this report only partially and very incompletely consider impacts and feedbacks caused by developing a projection for one of the three interacting water/energy/economic development variables. The potential for development of improved projection methods was discussed. Improved methodology will require research to determine the significance of identified relationships for the variables, and development in conjunction with institutional constraints. (See also W81-02432)(Zielinski-IPA)
W81-02433

A SUMMARY OF ENERGY MODELS AND ENERGY DEMAND PROJECTIONS FOR NEW ENGLAND,
Massachusetts Univ., Amherst.
T. H. Stevens.
In: A Methodology for Assessing the Regional Interrelationships of Water Resources, Energy Supply and Economic Development, Proceedings of the Workshop October 4-5, 1979, Boston, Massachusetts, p B1-B30, March, 1980. 6 Tab, 28 Ref.

Descriptors: *Computer models, *Energy, *Projections, *New England, Research priorities, *Regional development, Planning, Economic prediction, Estimated costs, Multiple-purpose projects, Institutional constraints, Legal aspects, Administration, Governments, Institutions, Political constraints, *Water policy, Project planning, Economic justification, Methodology, Decision making, Forecasting, Water resources development.

The objectives of this summary were to review existing energy forecasts of the New England region; to evaluate each, regarding assumptions and methods used; and to discuss implications for the development of an improved methodology for evaluating energy-water-economic interactions in New England. Four classes of energy models were identified: (1) optimization models; (2) simulation using econometrically-fitted parameters; (3) simulation using parametric analysis; and (4) economic structure models using input-output or other macroeconomic framework. Regardless of the model used, a wide range of alternative energy forecasts are possible, depending on assumptions and public policies considered. Examples of these are given and discussed. A combination of model types may be useful to this study, but model structure mixing is cautioned against. Econometric techniques might be used for short-run analysis; programming techniques may be preferable for long-run situation evaluation. Certain decisions must be made, including, system exogenous/endogenous factors, and the emphasis needed for distributional, environmental, and other non-efficiency issues. (See also W81-02432)(Zielinski-IPA)
W81-02434

ELECTRIC SECTOR PLANNING MODELS,
Brookhaven National Lab., Upton, NY.
P. M. Meier.
In: A Methodology for Assessing the Regional Interrelationships of Water Resources, Energy Supply and Economic Development, Proceedings of the Workshop October 4-5, 1979, Boston, Massachusetts, p C1-C16, March, 1980. 3 Tab.

Descriptors: *Electric power, *Computer models, *Projections, *New England, Research priorities, Regional development, Planning, Economic prediction, Estimated costs, Multiple-purpose projects, Institutional constraints, Legal aspects, Administration, Governments, Insitutions, Political constraints, Project planning, Economic justification, Methodology, Decision making, Forecasting, *Water resources development.

The objective of this paper was to explore the use of electric sector planning models within the overall framework of energy, economic and water resource development planning. The perspective adopted was that of the electric sector planner; the fundamental question posed was the degree to which other sectors should be considered to model the electric sector satisfactorily. A brief review is given of electric sector models and the results of their application to New England. Key guidelines were set forth for electric sector treatment alone, followed by integration of electric sector models into a wider integrating framework that adequately considers the links to the overall energy system, and to water resource and economic development. Recommended paths to an integrated framework were: (1) adopt an integrating model, well-tested at the national scale, and simply apply it to the regional scale with appropriate data base changes; (2) adopt a model already existing for New England, and build on it; (3) use existing models for component subsectors, and design a series of linkages around the submodels to produce an integrated system having the needed breadth and flexibility. (See also W81-02432)(Zielinski-IPA)
W81-02435

AN ANALYSIS OF ASSUMPTIONS BEHIND REGIONAL ECONOMIC DEVELOPMENT PROJECTION METHODOLOGIES,
M. Howland.
In: A Methodology for Assessing the Regional Interrelationships of Water Resources, Energy Supply and Economic Development, Proceedings of the Workshop October 4-5, 1979, Boston, Massachusetts, p D1-D49, March, 1980. 3 Ref.

Descriptors: *Computer models, *Regional development, *New England, *Economic prediction, Research priorities, Planning, Estimated costs, Multiple-purpose projects, Institutional constraints, Legal aspects, Administration, Governments, Institutions, Political constraints, Water policy, Project planning, Economic justification, Methodology, Decision making, Forecasting, *Water resources development.

The most widely-used regional economic projection methodologies have been described and analyzed to determine explicit/implicit assumptions about water and energy supply and demand, either incorporated within the model or treated as external variables exogenous to the model. Analysis of the major methodologies demonstrated two sets of acute weaknesses; one inherent in the national model, the other in the method of finding equivalent projections for regions. National economic projection techniques are largely determined within the strictly economic-mathematically oriented model without considering resource limita-

tions or social preferences. Historical evidence is a function of strict economic behavior only in part; strict application of this evidence to future (especially long-term) projections represents an acute weakness. Regional projections carry the weaknesses of the national models forward, and since smaller numbers are involved, are subject to greater statistical error. It should nonetheless, be possible to construct a general strategy from these background analyses. (See also W81-2432)(Zielinski-IPA)
W81-02436

SOME ASPECTS OF INSTITUTIONAL ANALYSIS FOR WATER, ENERGY AND ECONOMIC DEVELOPMENT IN THE NEW ENGLAND REGION,
Vermont Univ., Burlington.
M. B. Lapping.
In: A Methodology for Assessing the Regional Interrelationships of Water Resources, Energy Supply and Economic Development, Proceedings of the Workshop October 4-5, 1979, Boston, Massachusetts, p E1-E27, March, 1980.

Descriptors: *Institutional constraints, Planning, *Projections, *Estimated costs, *Regional development, *New England, Multiple-purpose projects, Constraints, Legal aspects, Administration, Governments, Institutions, Political constraints, Water policy, Project planning, Long-term planning, Short-term planning, Economic justification, Methodology, Research priorities, Decision making, Forecasting.

Two sets of materials were used to document this study. The first set consists of a listing of agencies within the region currently having a decision-making role in one or more areas of concern. A State case study was cited (Maine), indicating the nature of institutional linkages and relationships existing relative to planning and regulatory functions. The second set of materials consists of three charts that address the nature of energy regulation by State regulatory commissions, and illustrate that differences exist in the New England region in three critical elements (nature of energy utilities regulated; nature of rates or price structure used by utilities; factors creating rate structures as developed by the various State regulatory commissions). There do not appear to be substantive interrelationships in a given State for comprehensive examination of water, energy, and economic development policies/issues. These problems are further exacerbated by discrete subregional (north-south; urban/rural) value conflicts within New England. (See also W81-02432)(Zielinski-IPA)
W81-02437

COST EFFECT STREAM-GAGING STRATEGIES FOR THE LOWER COLORADO RIVER BASIN: THE BLYTHE FIELD OFFICE OPERATIONS,
Geological Survey, Reston, VA. Water Resources Div.
M. E. Moss, and E. J. Gilroy.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $16.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1048, December, 1980. 112 p, 46 Fig, 3 Tab, 12 Ref.

Descriptors: *Colorado River, *Cost analysis, *Network design, *Steam gages, *Basic data collections, Decision making, Streamflow, Networks, Time series analysis, Markov processes, Optimization, *Lower Colorado River basin.

This report describes the theoretical developments and illustrates the applications of techniques that recently have been assembled to analyze the cost-effectiveness of federally funded stream-gaging activities in support of the Colorado River compact and subsequent adjudications. The cost effectiveness of 19 stream gages in terms of minimizing the sum of the variances of the errors of estimation of annual mean discharge is explored by means of a sequential-search optimization scheme. The search is conducted over a set of decision variables that describes the number of times that each gaging route is traveled in a year. A gage route is defined as the most expeditious circuit that is made from a field office to visit one or more stream gages and return to the office. The error variance is defined as a function of the frequency of visits to a gage by using optimal estimation theory. Currently a minimum of 12 visits per year is made to any gage. By changing to a six-visit minimum, the same total error variance can be attained for the 19 stations with a budget of 10% less than the current one. Other strategies are also explored. (USGS)
W81-02455

WORK PLAN FOR THE SCHUYLKILL RIVER BASIN, PENNSYLVANIA: ASSESSMENT OF RIVER QUALITY AS RELATED TO THE DISTRIBUTION AND TRANSPORT OF TRACE METALS AND ORGANIC SUBSTANCES,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-02488

RESEARCH DESIGN AND MITIGATION PLAN FOR THE YELLOWHOUSE DAM AND RESERVOIR, PUEBLO OF ZUNI, NEW MEXICO,
Nickens and Associates, Montrose, CO.
S. M. Collins, and P. R. Nickens.
Report prepared for Water and Power Resources Service, Lower Colorado Regional Office, Boulder City, Nevada, March, 1980. 161 p, 1 Fig, 3 Tab, 95 Ref, 7 Append. 9-07-30-X0084.

Descriptors: *Indian reservations, *New Mexico, *Damsites, *Reservoir sites, Water resources planning, Research priorities, *Archaeology, National historic sites, Project planning, Dams, Water control, Zuni Indian Reservation.

The proposal to build a dam and reservoir at the confluence of the Rio Nutria and Rio Pescado on the Zuni Indian Reservation requires a mitigation plan to minimize the adverse effects on the archaeological sites in the area. Yellow House, a Registered National Historic Landmark, is one such site, which will be flooded periodically, and 205 other sites and 92 localities will be seriously affected. The mitigation plan comprises an outline summary of previous archaeological/historical investigation, a research design, and a recommended work plan. The research design seeks to refine chronology for Puebloan sites, establish past uses of natural resources, and reconstruct social relationships. Research questions and scientific procedures are suggested to achieve the general research goals. The work plan summarizes the sites by period, type, and impact, and the sites where each research procedure would be relevant. Thirty-six sites are recommended for habitation site studies, and 24 sites are recommended for the search for water control features or roads. Other sites are suggested for special studies to complete research procedures. (Brambley-SRC)
W81-02500

THE DEMAND FOR WATER TRANSPORTATION: APPLICATION OF DISCRIMINANT ANALYSIS TO COMMODITIES SHIPPED BY BARGE AND COMPETING MODES IN OHIO RIVER AND ARKANSAS RIVER AREAS,
Army Corps of Engineers, Fort Belvoir, VA.
L. G. Antle.
Research Report 80-R2, August, 1980, 153 p, 20 Fig, 19 Tab, 47 Ref, 1 Append.

Descriptors: *Transportation, *Barges, *Cost analysis, *Ohio River, *Arkansas River, Railroads, Roads, River basin development, Models, Pipelines, Pricing, Channels.

Discriminant analysis is utilized to calibrate a modal choice model from disaggregate observations of individual shipments. Transport demand functions for barge shipments are developed for coal used for energy and metallurgical markets. Barge demand functions are developed for commodities other than coal including chemicals and refined petroleum products. Data utilized in the analysis represents a total of 815 shipments totaling 145.9 million tons shipped annually for 14 major commodity groups utilizing 9 transport modes. Conventional rail and unit train modes comprised about 54% of the shipments and 33% of the annual tonnage in the sample. Barge transport accounted for 18% and 55% of the annual tonnage, with truck, pipelines and mixed modes accounting for the remainder. Demand estimates show the demand for barge transportation to be in-elastic. Relative price escalation from 2 to 5 times the values reflected in the data is required to achieve substantial decreases in the quantity shipped by barge. The impact of waterway user charges is not likely to cause significant diversion of traffic to other modes. This would allow competing modes to raise rates, reducing revenue deficiencies experienced by many rail carriers. The technological attributes of barge transportation remain as advantages for many waterways users over competing modes. (Brambley-SRC)
W81-02502

WATER SYSTEMS AUTOMATION AND MANAGEMENT, PART 1,
H. R. Williams.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 2-1, p 1-5.

Descriptors: *Water supply development, *Water management(Applied), *Automation, *Administration, Evaluation, Water supply, Water policy, Water measurement, Water quality standards, Training, Water users, Utilities.

Because of the importance of water in social and economic development, careful attention must be given to its management for optimum control, conservation and use. The goal is to establish the need for continual evaluation of practices, methods, procedures and policies used in managing water supplies. While operating policies will differ among water projects, the following water management objectives are applicable to all: purpose of the project; project operational policy; water supply forecasts; water measurement program; water records program; water quality standards; adequately rained operators; and public relations. Once objectives are identified, plans may be made for their implementation, evaluation of the results, and revisions may be made to correct weaknesses or meet changing conditions. (Brambley-SRC)
W81-02510

THE PRICING AND EVALUATION OF NATURAL RESOURCES,
Georgia Univ., Athens. Inst. of Natural Resources.
R. M. North.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-165649, Price codes: A08 in paper copy, A01 in microfiche. In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, GA, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC., Rpt. FWS/OBS-80/27, Nov., 1980, p 154-162. 1 Fig.

Descriptors: *Pricing, *Natural resources, *Economics, Coasts, *Wetlands, Evaluation, Economic impact.

Economics is defined as a study of any action or process which has to do with the creation of goods and services to satisfy human wants. The positive approach to economic thinking is to avoid moral, ethical, or normative judgements and to take the economic system as it is. The basis of the normative approach is to make value judgements respecting the performance of the economic system. For economic efficiency, a reasonable effective system of market pricing must be maintained. The problems in the pricing system are most noticeable in areas of natural resources and environmental concerns where markets are not well-defined. The three basic types of goods are economic goods, free goods, and public goods. An economic good is anything that has value in use or that is scarce. Free goods are those that are abundant, and therefore there is no price. Public goods are those which society values, but has no way of pricing to its individual members. Much of the nations natu-

ral resources fall into the category of public goods, or are in transition from a free good to a public good. There are five different methods of establishing the price for goods: market value to the consumer or participant; sectoral economic impacts; personal cost of participation; social value to the participant; and reservation value to potential participants. The reservation value is a measure of the willingness to reserve or maintain an opportunity to participate or enjoy a good in the future. This is the driving force behind the valuation of much of our natural resources, and things one would like to preserve for the future. (Moore-SRC)
W81-02543

GROUNDWATER MANAGEMENT WITH FIXED CHARGES,
Petroleos de Venezuela, Caracas. Exploration Dept.
For primary bibliographic entry see Field 4B.
W81-02605

PACKAGE PLANTS: A COST-EFFECTIVE SOLUTION TO SMALL WATER SYSTEM TREATMENT NEEDS,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
R. M. Clark, and J. M. Morand.
Journal of the American Water Works Association, Vol 73, No 1, p 24-30, January, 1981. 5 Fig, 10 Tab, 8 Ref.

Descriptors: *Water treatment facilities, *Performance, *Package plants, Water quality, Evaluation, Comparative costs, Safe Drinking Water Act, Reliability, Water purification, Municipal water, *Costs, Operating costs, Maintenance costs, Construction costs, Economies of scale, Treatment facilities, Coliforms, Hydrogen ion concentration, Turbidity, Metals, Trihalomethanes, Potable water.

Package water treatment plants consisting of prefabricated and largely preassembled clarification and filtration units are commonly used in the United States for small water supplies. A survey of 19 municipal and 17 recreational package water treatment systems produced the following performance data: pH, 6.5-8.6; coliforms, present in 3 of 31 systems; turbidity, 8 of 31 exceeding maximum federal standards; trihalomethanes, 5 of 31 exceeding 0.10 mg per liter; pesticides, none; silver, 2 systems; mercury, less than 0.001 mg per liter in several plants and 0.020 mg per liter in 1 municipal plant. Most aberrations in performance were ascribed to operator inattention or intermittent operation. Most package plants serve populations of 10,000 or less and have a capacity of 1.5 mgd or less. Comparative costs of a 1 million gallon per day conventional plant versus a package plant showed that the package plant was more economical. Construction costs for a conventional plant were $1,120,000 and annual operating and maintenance costs, $63,000; package plant, $488,000 and $40,000 respectively. (Cassar-FRC)
W81-02632

ENERGY IMPACT ANALYSIS IN WATER PROJECT PLANNING,
California Univ., Davis. Dept. of Land, Air and Water Resources.
R. M. Hagan, and E. B. Roberts.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 289-302, March, 1980. 1 Fig, 9 Tab.

Descriptors: *Energy costs, *Planning, *Project planning, Alternative planning, Waste water treatment, Water quality, Los Angeles, New Melones, California, Electric powerplants, Water resources development, Powerplants, Cost-benefit ratio, Economics, Water reuse.

Since the energy crisis is a relatively recent development compared with water shortages and pollution, this paper illustrates some problems in preparing and interpreting the impact of energy costs and availability on water project planning. Energy analysis should be carried out in energy units separately from the economic aspects. Total energy impact should be considered and should include items such as energy consumed in producing the electricity and energy consumed in producing steel for construction of a dam. Planning for the New Melones, California, water management project produced estimates from a maximum power production of 430 million kilowatt hours per year to a net loss of 3.9 million kilowatt hours per year. The proponents of the higher figure did not include energy costs, line losses incurred in delivery of power, and the flooding of the existing electric power plant. The opponents, who claimed the project would produce a loss in available energy, calculated costs in BTU of primary energy and benefits in BTU of delivered electricity with a benefit-cost ratio of 0.65. When the authors recalculated these figures and considered the savings produced by inactivation of the old power plant, the benefit-cost ratio increased to 2.7. If the reduction of decline in shallow wells is considered, the ratio rises to 4.1. Several other projects were evaluated using energy impact: average life and average maintenance costs for household items versus water quality, pollutants removed from waste water by three methods of treatment versus pollutants added to the environment, total energy requirements of water supply alternatives for the Los Angeles area, and total energy required for waste water reuse versus imported fresh water. (Cassar-FRC)
W81-02648

DESIGN OF LENGTH OF WATER RESOURCE SIMULATION EXPERIMENTS,
CDM, Waltham, MA.
G. J. Vicens, and J. C. Schaake, Jr.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 333-350, March, 1980. 7 Fig, 9 Tab, 17 Ref.

Descriptors: *Model studies, *Water resources, *Planning, Alternative planning, Benefits, Mathematical models, Streamflow, Rio Colorado, *Argentina, Correlation analysis.

Simulation models in water resource planning should take into account the reliability of information, based on a specific run length. One procedure compares two alternatives, pair-by-pair, and produces reliability levels for various simulation lengths. Correlated samples, serially and crosswise, may be included. A second procedure, which does not include correlated samples, compares more than two alternatives. The effect of cross-correlation tended to overcome the effect of serial correlation. Serially correlated samples increased the required number of observations, and cross correlation reduced the run length. A model was applied to the Rio Colorado, Argentina, basin to determine whether 50 year or 500 year simulation would produce reliable information. Even with weighting toward different objectives, i.e., increasing of national income vs. regional income, a 50 year run was sufficient to achieve greater than 90% reliability. (Cassar-FRC)
W81-02650

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

DECLINING BLOCK RATES CAN ENCOURAGE WATER CONSERVATION,
East Bay Municipal Utility District, Oakland, CA.
L. Sawchuk.
Journal of the American Water Works Association, Vol 73, No 1, p 13-15, January, 1981. 2 Tab, 3 Ref.

Descriptors: *Pricing, *Water conservation, *Utilities, Conservation, Water consumption, Water rates, Elasticity of demand, Industrial water, Public utilities.

Declining block rates, criticized as encourgaging waste and inefficiency, actually promote water conservation for most utilities with a diversified customer mixture. Using the price elasticity coefficients (usually -0.225 for residential users and -0.10 for commercial users), changes in consumption versus prices can be predicted and total revenues computed. The author claims that changing from a declining rate block to a single unit or inclining block pricing structure will result in increased total consumption whenever the average elasticity of demand for consumption in the higher priced blocks (low use) is larger than that of consumption in the lower priced blocks (high use). (Cassar-FRC)
W81-02614

MINIMIZING TREATMENT COSTS IN MULTIPLANT SETTINGS,
Duke Univ., Durham, NC. Dept. of Civil Engineering.
J. J. Peirce, E. F. Joeres, and M. H. David.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR2, p 427-438, July, 1980. 9 Fig, 1 Tab, 4 Ref.

Descriptors: *Cost sharing, *Joint costs, *Waste water treatment, Comprehensive planning, Water pollution control, Lake Michigan, Wisconsin, Optimization, Planning, Phosphorus compounds, Operating costs, Municipal wastes, Coordination, Cost analysis, Efficiencies, Cost allocation.

Methods for determining least cost operating schedules for groups of waste water facilities are developed and compared. These are applicable to cooperative operations where municipalities join together to remove pollutants most efficiently. A sample situation involves 3 of the 53 Wisconsin towns ordered to remove 85% of the phosphorus from water discharged into Lake Michigan. Whereas present methods use total cost curves in linear or nonlinear programming, the method described in this paper, usable for up to 20 towns, develops marginal cost curves (the cost of removing each additional unit of phosphorus) and average cost curves (represents the average cost for all units of phosphorus being removed). The equal average incremental cost method, a variation of the above, is more useful if total cost relationships are not continuous. Up to 10 facilities may be handled. For a large number of units, dynamic programming is necessary. (Cassar-FRC)
W81-02647

6D. Water Demand

NEW YORK'S WATER SUPPLY DILEMMA,
Metcalf and Eddy, Inc., New York.
G. P. Fulton.
Public Works, Vol 112, No 2, p 55-59, February, 1981. 2 Fig, 4 Tab.

Descriptors: *New York, *Water supply development, *Safe yield, Skimming, Droughts, Connecticut, New Jersey, Delaware River, Hudson River, Water supply, Water consumption, Water resources development, Water management(Applied), Low-flow augmentation, Impoundments, Reservoirs, Overflow, Municipal water, Planning.

Although water consumption in the metropolitan New York area decreased by 15% during the severe drought of the 1960's, the return of normal rainfall caused a quick return to less conservative water use habits. Daily per capita consumption has increased 29.4% in N.Y. City since 1968; 5.8 to 20.8% in the counties surrounding the city. In spite of these increases, no significant additions have been made to the available water supply. If a severe drought occurs, the greater N.Y. area would experience a 330 mgd deficit. Short term projects (3 to 5 years) were proposed to alleviate the deficit until completion of proposed major water supply projects divert and store excess runoff in impoundment basins, specifically the Hudson River and Chelsea pumping station, Beaver Kill, Round Valley, and the Pompton-Passaic Rivers confluence. Possible long term projects (12 to 20 years) would all use water from the main stems of the present sources, the Delaware and Hudson Rivers, and include the Tocks Island Reservoir on the Delaware, the Gooley Reservoir

to store water taken near Poughkeepsie, and high flow skimming of the Hudson River. (Cassar-FRC)
W81-02569

6E. Water Law and Institutions

WATER QUALITY LEGAL ISSUES AND LAND USE IN A SHARED ESTUARY,
Rhode Island Univ., Kingston.
J. J. Kupa.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185324, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, (1980), 12 p, 2 Fig, 1 Tab. OWRT-A-069-RI(1), 14-34-0001-9042.

Descriptors: *Estuaries, *Water quality, Water pollution, *Water rights, *Legal aspects, *Land use, *Urbanization, *Interstate rivers, Bodies of water, Bays, Aquatic habitats, Estuarine environment, Rivers, Water quality control, Biochemical oxygen demand, Connecticut, Rhode Island, Boundary disputes, Water law, Land development, Drainage, Land resources, Interstate commissions, Watershed management, *Little Narragansett Bay.

This research studied the relationship between alternative land use plans for an estuary (Little Narragansett Bay) shared by two States (Connecticut and Rhode Island), and their relative effects on estuarine water quality. The study area consisted of watersheds of Westerly, Rhode Island and Stonington, Connecticut, which border the Pawcatuck River and the estuary. Land use in these has a definite impact on water quality. At present, urban runoff from the local watersheds of both towns provides a significant BOD5 source in the estuary. Computer modeling predicts that BOD5 from urban runoff with as little as 25% future land development will exceed the BOD5 contribution of the sewage treatment plants on the estuary. The findings of this study demonstrate the need for cooperative land user planning across State borders to reduce the water quality deterioration potential for common estuaries. Legal and innovative institutional mechanisms were developed to meet the challenge of this cooperative effort. Recommendations for future land use development were proposed. (Zielinski-IPA)
W81-02404

CONFLICTS OVER THE COLUMBIA RIVER, SEMINAR CONDUCTED BY WATER RESOURCES RESEARCH INSTITUTE, OREGON STATE UNIVERSITY, SPRING QUARTER 1980.
For primary bibliographic entry see Field 6B.
W81-02418

NEW DIRECTIONS IN WATER POLICY, SEMINAR CONDUCTED BY WATER RESOURCES RESEARCH INSTITUTE, OREGON STATE UNIVERSITY, FALL QUARTER 1979.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185340, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, Oregon State Univ., Corvallis. Report SEMIN WR 027-80, January, 1980. 41 p, 2 Fig, 4 Tab, 1 Append. OWRT-A-999-ORE(27).

Descriptors: *Water policy, *Oregon, *Public rights, *Legal aspects, *Planning, Institutions, Governments, State jurisdiction, Water law, Future planning(Projected), Decision making, Water demand, Constitutional law, Water resources development, Institutional constraints, Water, Competing uses, Water resources, Electric power, Interstate.

This seminar was held to examine some of the Oregon factors involved in a broad set of water policy initiatives announced by President Carter on June 1978 to bring about 'reforms' in: Federal-State cooperation, water planning processes, water conservation, and increased environmental sensitivity. Five papers were presented: Federal/State water policy issues; water and public control; policies and aquatic ecosystems; water resources and land use planning; and energy and water policy in the Columbia River. Emerging water policy issues involve coordination between land use, water quality and quantity planning, increasing community demands, municipal and agricultural supplies, hydroelectric power development, and Oregon's role in water resource development. Contrasting approaches were noted to allocating water to minimum flows in Colorado and Montana, the former using public participation in the market rather than public regulation of the market. Policy and administrative mechanisms of the Oregon Department of Fish and Wildlife to assure adequate water supply for State fish/wildlife resources was also delineated. It was concluded that future developments of the Columbia River lie not on the River, but on its tributaries. (Zielinski-IPA)
W81-02419

WATER, ENERGY, AND ECONOMIC DEVELOPMENT TOWARDS AN INTEGRATED REGIONAL POLICY ANALYSIS SYSTEM,
Rhode Island Univ., Kingston.
For primary bibliographic entry see Field 6B.
W81-02430

WATER, ENERGY, AND ECONOMIC DEVELOPMENT TOWARDS AN INTEGRATED REGIONAL POLICY ANALYSIS SYSTEM, SELECTED BACKGROUND ESSAYS.
For primary bibliographic entry see Field 6B.
W81-02431

EFFECTIVE WASTE WATER MANAGEMENT PLANNING,
California Univ., Davis. Dept. of Civil Engineering.
R. F. Barror, and G. Tchobanoglous.
Public Works, Vol 111, No 8, p 76-80, August, 1980. 2 Fig, 15 Ref.

Descriptors: *Federal project policy, Management, *Grants, Government finance, Rural areas, Planning, Municipalities, *Waste water management.

Waste water management planning is examined with respect to the federal regulatory process, the grant process, and the unique considerations of small communities. Small communities tend to be under-managed, and municipal services requiring capital investments do not always have the financial support they need. Planning for water pollution control can be improved by making the water treatment system as flexible as possible. The project should not necessitate a long-term commitment for non-renewable resources, and the facility should make use of unemployed unskilled labor and available land. Treatment facilities may need to expand in the future, or reduction of waste water flow through conservation may be all that is needed to upgrade the plant. Federal involvement primarily pertains to the EPA construction grants. Revamping the EPA Construction Grants Program is needed to emphasize not only innovative technologies but also innovative planning and management concepts. Economic and other incentives are needed at the local and regional levels to encourage effective waste water management planning. (Small-FRC)
W81-02567

HAZARDOUS WASTE MANAGEMENT: STATE BY STATE.
For primary bibliographic entry see Field 5B.
W81-02597

REAGAN TEAM'S BLUEPRINT TO EPA.
Journal of the Water Pollution Control Federation, Vol 53, No 1, p 16-20, January, 1981.

Descriptors: *Environmental Protection Agency, *Heritage Foundation, *Water quality, *Water pollution control, *Regulations, Water policy, Legal aspects, Legislation, Administration, Governments, Standards, Waste water treatment.

The 3000 page Heritage Foundation report, 'Mandate for Leadership: Policy Management in a Conservative Administration,' concerns 20 areas of study, one of which is the EPA. Some of the criticisms of EPA's water quality program are as follows: policy level personnel lack proper training and experience, federal agencies distribute funds according to formula and numbers, standards for quality in some cases are lower than natural waters, carcinogen standards are very low, federal contact with industries and cities is in an adversary role rather than in a leadership or assistance role, model calculations are not calibrated or verified for the particular water body, adequate water quality monitoring is not required, secondary treatment has been poorly defined, EPA regulations are unintelligible and contradictory, the zero discharge goal is impossible and inflexible, and decisions are frequently based on insufficient data. A list of recommendations to alleviate the above problems is given. Emphasis is on good personnel, less orientation toward perfection, meeting reasonable deadlines, more power to the states, focus on critical areas, review of standards, legislation to protect groundwater quality, and transfer of environmental control programs to other, more experienced federal agencies. (Cassar-FRC)
W81-02613

ICPRB AND WASHINGTON METRO WATER MANAGEMENT,
Interstate Commission on the Potomac River Basin, Rockville, MD.
D. P. Sheer, and P. W. Eastman.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 303-317, March, 1980. 4 Fig, 1 Tab, 15 Ref.

Descriptors: *Planning, *Water management(Applied), *District of Columbia, *Regional development, Waste water treatment, Water supply, Potomac River, Governments, Sewer expansion simulation, Risks, Model studies, Water quality, Water resources, Water policy, Interstate rivers, Interstate commissions, Interstate Commission on the Potomac River Basin.

Responsibilities for water supply and waste water treatment in the Washington, DC., area are divided among many local, state, and federal agencies. The Interstate Commission on the Potomac River Basin (ICPRB) is cited as an example of effective regional coordination in both water quality and water supply management. The ICPRB mediates disputes among the jurisdictions, is developing a sewer expansion simulation to aid in planning, and provides information and technical assistance. Two techniques for estimating risk and the impact of changing operating policies on risk were developed and implemented. Risk analysis is a simulation of reservoir operation using historical streamflows. This was first used to study the Occoquan Reservoir in September 1977. Although water supply and waste treatment organization remains complex and fragmented in this area, increasing regionalization will be seen; for example, interconnections between utilities and coordinate water use during droughts. The low flow allocation agreement for the Potomac River made a significant contribution to better coordination in planning. (Cassar-FRC)
W81-02649

6G. Ecologic Impact Of Water Development

COASTAL HABITAT DEVELOPMENT IN THE DREDGED MATERIAL RESEARCH PROGRAM,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
H. K. Smith.
In: Rehabilitation and Creation of Selected Coastal Habitats: Proceedings of a Workshop, Sapelo Island, Georgia, 16-20 May, 1976. Fish and Wildlife Service, Biological Services Program, Washington, DC., Report FWS/OBS-80/27, November, 1980, p 117-125. 1 Fig, 1 Tab.

Descriptors: *Habitats, *Dredging, *Disposal, *March management, Wetlands, Aquatic habitats,

Land management, Water quality, Dewatering, Dikes, Engineering structures, Islands, Dredging, Channel improvement, Coasts, Spoil banks.

Annual maintenance dredging volumes for Army Corps of Engineers projects exceed 214,100,000 cubic m, with new work producing approximately 61,200,000 cubic m. The large volumes of dredged material often present extraordinary disposal problems. The Dredged Material Research Program has been divided into 4 project areas. The Environmental Impacts and Criteria Development Project is the focal point for research about the effects on water quality and aquatic organisms of both land and open-water disposal as well as land containment of dredged material. The Disposal Operations Project is primarily concerned with improving the efficiency of dredged material disposal, including dike design and improvement of dewatering techniques, landscaping, silt curtain performance, and treatment of contaminated dredged material. The basic philosophy of the Productive Uses Project is to develop new or innovative disposal methods, primarily on land, to provide disposal alternatives which derive maximum value from the resource potential of dredged material. The Habitat Development Project is divided into five tasks: the effects of dredged material disposal on marsh and terrestrial habitat, marsh development, terrestrial habitat development, aquatic habitat development, and island habitat development. Habitat development using dredged material offers an alternative disposal method that is often feasible from a biological, engineering, and economic standpoint. Careful implementation of this alternative could significantly increase the extent of wetland resources in parts of the United States. (Moore-SRC)
W81-02537

THE PRICING AND EVALUATION OF NATURAL RESOURCES,
Georgia Univ., Athens. Inst. of Natural Resources.
For primary bibliographic entry see Field 6B.
W81-02543

7. RESOURCES DATA

7A. Network Design

COST EFFECT STREAM-GAGING STRATEGIES FOR THE LOWER COLORADO RIVER BASIN: THE BLYTHE FIELD OFFICE OPERATIONS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6B.
W81-02455

COMPUTER PROGRAM FOR NETWORK ANALYSIS FOR REGIONAL INFORMATION,
Geological Survey, Reston, VA. Water Resources Div.
E. J. Gilroy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-159345, Price codes: A03 in paper copy, A04 in microfiche. Geological Survey Water-Resources Investigations 79-104, November, 1980. 41 p, 3 Fig, 3 Ref.

Descriptors: *Computer programs, *Network design, *Regression analysis, *Data collections, Probability, Estimating, Streamflow, Flow characteristics, Ungaged sites, *Bayesian analysis, Model errors.

The computer program MODLVALU enables the designer of a hydrologic-data network to apply the Network Analysis for Regional Information (NARI) technique of hydrologic network design based upon a regional regression analysis. The input to MODLVALU consists of (1) the observed standard error of estimate of the regional regression for either the mean, the standard deviation, the 2-yr, 10-yr, 50-yr or 100-yr event, (2) a probabilistic description of the design region's hydrology in terms of joint prior probabilities of the coefficient of variation and cross-correlation coefficient and (3) the level of data availability - the number of measurement sites and harmonic mean record length - associated with the data used in the regional regression. The output of MODLVALU consists of a family of probability distributions of the true standard error of estimate of the regional regression equation. The true standard error of estimate is a measure of the accuracy of using the regression equation to estimate the streamflow characteristic at ungaged sites in the design region. This family of distributions is indexed by the levels of data availability chosen for consideration by the network designer. (USGS)
W81-02483

WATER RESOURCES ACTIVITIES IN ILLINOIS, 1980,
Geological Survey, Champaign, IL. Water Resources Div.
M. L. Garrelts.
Geological Survey Illinois District Report, 1980. 56 p.

Descriptors: *Illinois, *Water resources, *Projects, Water year, *Reviews, Surface waters, Groundwater, Programs, Data collections, Streamflow, Discharge(Water), Floods, Water quality, Hydrology, Sampling, Measurement, Sites, Project type, Project objective, Project approach, Project progress.

This report details the activities of the U.S. Geological Survey, Water Resources Division in Illinois. Part A of the report contains two tables. Table 1 shows station numbers, names, and types of data collected for surface-water stations. Table 2 shows station numbers and names grouped by counties for groundwater stations. Part B contains a brief outline of the status of water resources projects in progress in Illinois during 1980 water year and projects to begin in the 1981 water year. (USGS)
W81-02485

7B. Data Acquisition

MODIFIED ROTARY SHAKER PLATFORM,
Missouri Univ., Kansas City. Dept. of Biology.
D. H. Stern, and M. S. Stern.
The Progressive Fish-Culturist, Vol 42, No 3, p 188-189, July, 1980. 1 Fig, 2 Ref. OWRT-A-099-MO(3).

Descriptors: *Cultures, Bacteria, Water quality, *Laboratory equipment, *Design criteria, *Laboratory tests, Microorganisms, Bioindicators, Aquatic life, Aquatic microorganisms, Aquatic bacteria, Aquatic microbiology, Water analysis, Water pollution, Aquatic environment, Ecology, Microbiology, Environment, Analytical techniques, Assay, Laboratories, Testing, Laboratory flasks, Mixing equipment.

An earlier rotary shaker platform design to hold 500 mL Erlenmeyer flasks had been reported for culturing Selenastrum capricornutum. Based on a recent study by the authors, the shaker platform was modified to use 125 mL, 250 mL, or 500 mL flasks. This modification can accommodate up to 55 flasks in any combination of sizes. The platform measures 22.5 by 48 inches, and easily fits into a reach-in environmental chamber with the shaker tachometer exposed. The platform is used without inserts for 500 mL flasks, or with inserts made from 1.27 cm thick sheets of rigid white Styrofoam. Characteristics of the platform have been delineated. The shaker system has been in continuous use for more than a year without damage to the platforms or power units. The platform with inserts increases power unit capacity over that of equipped with a stock platform, while providing flask size flexibility and reducing platform cost. Further, inserts broken periodically still remain rigidly in place and can continue to be used. (Zielinski-IPA)
W81-02442

SCINTILLATION DETECTORS IN GAMMA SPECTRAL LOGGING: GEOMETRY, ABSORPTION AND CALIBRATION,
Geological Survey, Denver, CO. Water Resources Div.
U. Schimschal.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $4.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-688 (WRI), 1980. 29 p, 8 Fig, 10 Ref.

Descriptors: *Borehole geophysics, *Calibrations, *Analytical techniques, *Mathematical models, Instrumentation, Gamma rays, Logging(Recording), Absorption, Radiation, Evaluation, *Gamma spectral logging, Scintillation crystal, Geometric effects.

The theory for the evaluation of the effects of geometry in gamma ray absorption is developed for cylindrical scintillation detectors as applicable to borehole gamma spectrometry. The results of a laboratory experiment are shown for comparison. A calibration procedure to determine detector efficiency is given for application to borehole probes. It is shown that the response of a crystal can be separated in terms of geometric effects and instrumentation effects. It is also shown that approximating crystal detectors with point detectors in mathematical theory is grossly oversimplified. (USGS)
W81-02460

CALIBRATION AND TESTING OF SELECTED PORTABLE FLOWMETERS FOR USE ON LARGE IRRIGATION SYSTEMS,
Geological Survey, Denver, CO. Water Resources Div.
R. R. Luckey, F. J. Heimes, and N. G. Gaggiani.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121345, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-72, 1980. 21 p, 9 Fig, 1 Tab, 1 Ref.

Descriptors: *Calibrations, *Testing, *Flowmeters, *Irrigation systems, Flow measurement, Discharge measurement, Pipe flow, Instrumentation, High Plains region, Gated-pipe meter, Doppler meter, Transient-time meter.

Existing methods for measuring discharge of irrigation systems in the High Plains region are not suitable to provide the pumpage data required by the High Plains Regional Aquifer System Analysis. Three portable flowmeters which might be suitable for obtaining fast and accurate discharge measurements on large irrigation systems were tested. A propeller type gaged-pipe meter, a Doppler meter, and a transient-time meter were tested under both laboratory and field conditions during 1979. The gated-pipe meter was found to be difficult to use and sensitive to particulate matter in the fluid. The Doppler meter, while easy to use, would not function on steel pipe 6 inches or larger in diameter, or on aluminum pipe larger than 8 inches in diameter. The transient-time meter was more difficult to use than the other two meters; however, this instrument provided a high degree of accuracy and reliability under a variety of conditions. Of the three meters tested, only the transient-time meter was found to be suitable for providing reliable discharge measurements on the variety of irrigation system used in the High Plains region. (USGS)
W81-02464

THERMAL ANALYSIS OF THE ISCO 1680 PORTABLE WASTE WATER SAMPLER,
Environmental Monitoring and Support Lab., Cincinnati, OH.
P. C. L. Lin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-222425, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/4-80-033, June, 1980. 46 p, 13 Fig, 5 Ref.

Descriptors: *Sample preservation, *Waste water, *Mathematical models, Thermal properties, Water sampling, Model studies, Automation, Sampling.

The heat transfer characteristics of an automatic waste water sampler were investigated to provide

a mathematical model with which manufacturers can design a portable sampler capable of preserving samples under certain extreme environmental conditions using ice. A mathematical model was developed to simulate the operation of the ISCO 1690 automatic waste water sampler. Data obtained during operation of the ISCO sampler cooling system under varying conditions indicated that the accuracy of the mathematical model was within plus or minus 2 degrees C. The theoretical sample temperature history was in phase with that of the corresponding test sample. The sampler insulation is found to be insufficient, and the cooling rate is slow. Based upon the mathematical model, two prototype redesigns of the sampler cooling system are proposed. The first new design would require 13.6 kg of ice to lower the temperature of 24 500-ml samples to about 4 degrees C at a cycle time of 1 hour, with an environment and initial sample temperature of 30 degrees C during a 24 hour period. The second design would require 9.6 kg of ice to keep the same amount of sample to about 4 degrees C at an environmental temperature of 35 degrees C. This project verified the feasibility of using mathematical models for the development of specifications for a sampler cooling system. (Moore-SRC)
W81-02499

WATER SYSTEMS AUTOMATION AND MANAGEMENT, PART 4,
L. A. Brower.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 2-4, p 1-8.

Descriptors: *Computers, *Data processing, *Irrigation systems, *Irrigation districts, Design data, Automation, Irrigation engineering, Remote control, Electronic equipment, Decision making, Management, Cost analysis.

There are many names given to the type of computer best suited for the requirements of an irrigation district, including minicomputer, microcomputer, small business computer, personal home computer, and intelligent terminal. These minicomputers are usually small in size, and do not require a special environment. Generally, a minicomputer consists of a keyboard similar to a typewriter but with a few more special keys, a cathode ray tube, a data storage device using tape cassettes or diskettes, and a printer. The selection of a small or minicomputer depends on the needs and funds of a particular district, and the possibility of sharing time with another district. Computers may be used for routine record keeping including personnel records, scheduling of irrigation based on input from individual farmers, and inventory system equipment service records, aid in solving design problems and calculations for engineering staff, and in remote control and automation of the system. Steps in the process of choosing a minicomputer are presented to help staff to decide what is needed and how to make the important decisions. A glossary of computer terminology is presented. (Brambley-SRC)
W81-02513

COMPUTER-BASED MONITORING FOR AVONMOUTH STW.
Water Services, Vol 84, No 1017, p 669-670, November, 1980. 2 Fig.

Descriptors: *Monitoring, *Sewage treatment, *Computer programs, Instrumentation, Data collection, Control systems, Waste treatment.

The computer based monitoring system employed at Avonmouth Sewage Treatment Works is described. Sludge produced at the treatment plant is held in digesters, and the methane produced provides power for the on-site generating station. The generating station provides enough electricity to run the works, the inlet pumping stations and a County Council incinerator. The monitoring system controls the general plant functions and regulates the methane/diesel fuel mix in the generators. The remote units collect data from seven dual-fuel engines and associated alternators, pumps, gas compressors, gas supply, switchgear and the digestion plant, and monitor other points of interest. The computer concept, called dMACS (distributed monitoring and control system) is linked to a microcomputer. When the system is fully completed it will provide all relevant and current information about the engines in the control room, activate automatic alarms to signal the need for any remedial steps, automatically shut down the dual-fuel engines in the event a serious fault develops, record events and conditions leading to a major fault, provide a single operations control panel to initiate all plant functions, and form in the long run the basis for information storage and retrieval on the whole works. (Baker-FRC)
W81-02589

THE PERFECT TELEMETRY MIX,
D. Barclay.
Water Services, Vol 84, No 1017, p 661-662, November, 1980. 1 Fig.

Descriptors: *Telemetry, *Instrumentation, *Monitoring, Data collection, Data transmission, Control systems, *Flood protection, Warning systems, Telephone.

An unusual mix of telemetry media is described which uses verbal and digital systems with data transmitted over private telephone wires (PW) and the public telephone network (PSTN). This provides a cost effective network of data transfer suited to the needs of each of the various locations in a complex river system, and of the different parameters monitored. Early warning of flood build-up at the headwaters of the Lea and its tributaries is received from another PSTN telemetry system called Radie. The automatic device calls several telephone numbers in succession until it gets an answer, at which point it relays a prerecorded message to the engineer on duty concerning a specific water level that is approaching a danger point. Telemetry via the PSTN has the advantage of being extremely low cost and easy to install. (Baker-FRC)
W81-02590

TELEMETRY SYSTEM AT GRAFHAM WATER SCHEME.
Water Services, Vol 84, No 1017, p 670, 673, 674, November, 1980. 2 Fig.

Descriptors: *Monitoring, *Telemetry, Control systems, Instrumentation, *Data transmission.

The Grafham Water Scheme, part of the Anglian Water Authority, is described. The Scheme can supply up to 227,300 cubic meters/day of treated water to the Bedford and Northampton Divisions and the Lee Valley Water Company. Water originates from the River Ouse. The telemetry system at the control center enables the operator to monitor the entire storage, treatment and distribution network. A flow diagram is pictured which shows the hydraulic arrangement within the monitoring area. The monitor concept allows precise control and simple adjustment of proble and sample temperatures, separate addition of EDTA before any other reagents, and automatic checking and self-standardization at two concentrations at preset time intervals. The monitor is suitable for use in river, sewage works effluent and many industrial applications. It can be used alone or in concert with a large monitoring scheme. The new range of ion selective monitors being developed will find application in various situations, including monitoring ammonia in coke oven effluents, chloride infiltration into boreholes, and cyanide in plating works effluent. (Baker-FRC)
W81-02600

POINT-VELOCITY DISCHARGE MEASUREMENT METHOD FOR SEWERS,
Auburn Univ., AL. Dept. of Civil Engineering.
A. D. Parr, J. F. Judkins, Jr., and T. E. Jones.
Journal of the Water Pollution Control Federation, Vol 53, No 1, p 113-118, January, 1981. 3 Fig, 2 Tab, 9 Ref.

Descriptors: *Flow measurement, *Manning's equation, *Channel flow, *Sewers, Discharge measurement, Point-velocity discharge, Equations, Discharge(Water), Pipe flow, Open channel flow, Measurement, Non-uniform flow.

Flow in a partially full sewer was monitored using the point-velocity discharge method. This method is accurate and economical. Measurements of depth and velocity at a single location on the vertical centerline of the pipe were used in an equation describing fully turbulent open channel flow in circular pipes. A family of empirical velocity distribution curves dependent on relative depth of flow were developed and combined with Manning's equation to produce the equation. A second formula may be used to calculate discharge in a full-flowing sewer. (Cassar-FRC)
W81-02616

7C. Evaluation, Processing and Publication

ANALYSIS AND DISSEMINATION OF WATER QUALITY AND WATER QUANTITY DATA,
South Dakota State Univ., Brookings. Water Resources Inst.
J. L. Wiersma, C. G. Carlson, A. R. Bender, and J. H. Bischoff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-185597, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, February, 1981. 48 p, 4 Fig, 3 Tab, 7 Ref. OWRT-A-065-SDAK(1), 14-34-0001-7088.

Descriptors: *Hydrologic data, *Water quality, Water needs, *Water resources, Data collections, *Computer programs, *Information retrieval, Water measurement, Water requirements, Basic data collections, Data storage and retrieval, Data transmission, Information exchange, Measurement, Networks, Monitoring, Computer models, Programming languages, Analysis, Sampling, Surveys.

It was the purpose of this project to develop computer programs for the dissemination of available data and research results in a form useful to the general public (including political decision-makers, planners, producers of goods, and even those who represent technical areas in disciplines not closely allied with the immediate subject field). Particular emphasis was placed on fulfilling needs of producers of goods and decision makers. The computer programs presented in this report are part of a spontaneous process that grows with the researcher's needs. These programs may be modified or integrated, depending on developing needs, and can provide the basis for new ideas or continuing research. To illustrate, a program developed for the Conservation Commission has led to a more critical appraisal of present monitoring programs; Project B-053 represents a continuation of work in the soil-water compatability area. The software programs presented in this report were written for use on a commercial programmable calculator having peripherals and printer/plotter capability. The programming language is HPL. (Zielinski-IPA)
W81-02424

MAPS SHOWING GROUNDWATER CONDITIONS IN THE LOWER SAN PEDRO BASIN AREA, PINAL, COCHISE, PIMA, AND GRAHAM COUNTIES, ARIZONA--1979,
Geological Survey, Tuscon, AZ. Water Resources Div.
S. C. Jones.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $7.00 in paper copy, $1.00 in microfiche. Geological Survey Open-File Report 80-954 (WRI), July, 1980. 10 Ref, 2 Sheets.

Descriptors: *Maps, *Groundwater, *Water wells, *Water levels, *Water quality, Specific conductivity, Fluorides, Aquifers, Hydrographs, Water level fluctuations, Pumping, Irrigation, Water yield, *Arizona, Lower San Pedro basin area(AZ), Pinal County(AZ), Cochise County(AZ), Pima County(AZ), Graham County(AZ).

The lower San Pedro basin area includes about 1,550 square miles in southeastern Arizona. The area depends almost entirely on groundwater for its water supplies. In 1978 the estimated groundwater pumpage was 55,000 acre-feet, 30,000 acre-feet of which was used for irrigation. Withdrawal of groundwater has had little effect on groundwater levels in the area. Information shown on the maps includes depth to water, altitude of the water level, spring discharge, chemical quality of the groundwater, and irrigated area. Hydrographs of the water level in selected wells and a table of historical pumpage also are included. Scale 1:125,000. (USGS)
W81-02450

HYDROLOGY AND CHEMICAL QUALITY OF GROUNDWATER IN CROWLEY COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
D. Cain, B. J. Ryan, and P. J. Emmons.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $6.25 in paper copy, $1.00 in microfiche. Geological Survey Open-File Report 80-681 (WRI), 1980. 22 Ref, 2 Sheets.

Descriptors: *Groundwater, *Water quality, *Hydrogeology, *Aquifers, *Colorado, Aquifer characteristics, Alluvium, Water wells, Water yield, Dissolved solids, Specific conductivity, Chemical analysis, *Arkansas River(CO), Crowley County(CO).

Significant quantities of groundwater can be obtained from several alluvial water-table aquifers possibly from two deep confined sandstone aquifers in Crowley County, Colo. The major water-table aquifer is the alluvium along the Arkansas River valley where well yields may be as much as 2,000 gallons per minute. Minor alluvial aquifers with well yields ranging from 5 to 200 gallons per minute occur in the drainage basins of Horse Creek, Bob Creek, and Sand Arroyo, and in alluvium underlying dune sand in the western part of the county. The Dakota Sandstone and the underlying Cheyenne Sandstone are the confined aquifers. The depth to the top of the Dakota Sandstone ranges from 700 to 3,600 feet below land surface. These aquifers are currently undeveloped but well yields may be as much as 275 gallons per minute. The chemical quality of water in the aquifers varies widely with dissolved solids ranging from about 400 to 8,000 milligrams per liter. On the basis of 35 analyses of water samples, only 2 samples met drinking-water standards for all constituents determined. In most instances, the water is suitable for agricultural uses. (USGS)
W81-02451

HYDROLOGY OF THE LAKE DEATON AND LAKE OKAHUMPKA AREA, NORTHEAST SUMTER COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2H.
W81-02452

ALTITUDE OF THE WATER TABLE IN THE ALLUVIAL AND WILCOX AQUIFERS IN THE VICINITY OF RICHLAND AND TEHUACANA CREEKS AND THE TRINITY RIVER, TEXAS, DECEMBER 1979,
Geological Survey, Austin, TX. Water Resources Div.
S. Garza.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $1.00 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-1007, March, 1980. 1 Sheet.

Descriptors: *Maps, *Groundwater, *Aquifers, *Water table, *Texas, Water levels, Water wells, Contours, Richland Creek(TX), Tehuacana Creek(TX), *Trinity River(TX).

This map shows the altitude of the water table in the alluvial and Wilcox aquifers in the vicinity of Richland and Tehuacana Creeks and the Trinity River, Tex., in December 1979. The water-table contours were constructed on the basis of water-level control derived from an inventory of shallow wells in the area, topographic maps, and field locations of numerous small springs and seeps. (USGS)
W81-02453

SEDIMENT AND WATER DISCHARGE OF THE COLORADO RIVER AT MATAGORDA, TEXAS, MAY 4-7, AND JUNE 7-11, 1979,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2J.
W81-02459

WATER-LEVEL CONTOUR AND SALT-FRONT MAP, HIALEAH-MIAMI SPRINGS WELL FIELD AREA, DADE COUNTY, FLORIDA, OCTOBER 13, 1978,
Geological Survey, Miami, FL. Water Resources Div.
L. J. Swayze.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $2.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-8, 1980. 1 Sheet.

Descriptors: *Maps, *Water table aquifers, *Water wells, *Water levels, *Florida, Drawdown, Salinity, Chlorides, *Dade County(FL), Well fields.

Water-level measurements of the shallow water-table aquifer were made around the Hialeah-Miami Springs well field in Dade County, Fla., on October 13, 1978. These measurements are generally made in October and May of each year to provide cooperators with a picture of the cone of depression of the well field. The cone of depression is also correlated with the 1000 milligrams per liter isochlor at the base of the aquifer. (USGS)
W81-02461

MAPS SHOWING GROUNDWATER CONDITIONS IN THE UPPER SAN PEDRO BASIN AREA, PIMA, SANTA CRUZ, AND COCHISE COUNTIES, ARIZONA--1978,
Geological Survey, Tucson, AZ. Water Resources Div.
A. D. Konieczki.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $7.00 in paper copy, $1.00 in microfiche. Geological Survey Open-File Report 80-1192 (WRI), October, 1980. 13 Ref, 2 Sheets.

Descriptors: *Maps, *Groundwater, *Irrigation wells, Water wells, *Water levels, Water quality, Specific conductivity, Fluorides, Hydrographs, *Arizona, *Upper San Pedro basin area(AZ), Pima County(AZ), Santa Cruz County(AZ), Cochise County(AZ).

The upper San Pedro basin area includes about 1,800 square miles in southeastern Arizona. The main use of groundwater is for irrigation. During 1966-77, about 481,000 acre-feet of groundwater was withdrawn. Except near Sierra Vista and Fort Huachuca, the groundwater withdrawals have had little effect on water levels. Information shown on the maps includes altitude of the water level, depth to water, depth of well, hydrographs of the water level in selected wells, irrigated area, and specific conductance and fluoride concentration in the water. A table of pumpage also is included. (USGS)
W81-02462

WATER QUALITY DATA FOR AQUIFERS, STREAMS, AND LAKES IN THE VICINITY OF KEECHI, MOUNT SYLVAN, OAKWOOD, AND PALESTINE SALT DOMES, NORTHEAST TEXAS SALT-DOME BASIN,
Geological Survey, Austin, TX. Water Resources Div.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $13.00 in paper copy, $6.00 in microfiche. Geological Survey Open-File Report 80-2037, November, 1980. 93 p, 6 Fig, 5 Tab, 5 Ref. Carr, J. E., Halasz, S. J., and Liscum, F., Compilers.

Descriptors: *Water quality, *Aquifers, *Streams, *Lakes, *Texas, Groundwater, Surface waters, Data collections, Sites, Streamflow, Flow measurement, Chemical analysis, Water analysis, *Northeast Texas, Salt domes.

This report contains water-quality data for aquifers, streams, and lakes in the vicinity of Keechi, Mount Sylvan, Oakwood, and Palestine Salt Domes in the northeast Texas salt-dome basin. Water-quality data were compiled for aquifers in the Wilcox Group, the Carrizo Sand, and the Queen City Sand. The data include analyses for dissolved solids, pH, temperature, hardness, calcium, magnesium, sodium, bicarbonate, chloride, and sulfate. Water-quality and streamflow data were obtained from 63 surface-water sites in the vicinity of the domes. These data include water discharge, specific conductance, pH, water temperature, and dissolved oxygen. Samples were collected at selected sites for analysis of principal and selected minor dissolved constituents. (USGS)
W81-02463

WATER RESOURCES DATA FOR NEW HAMPSHIRE AND VERMONT, WATER YEAR 1979.
Geological Survey, Boston, MA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-159592, Price codes: A09 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NH-VT-79-1, December, 1980. 176 p, 3 Fig, 1 Tab.

Descriptors: *New Hampshire, *Vermont, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water-resources data for the 1979 water year for New Hampshire and Vermont consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 78 gaging stations, stage records for 3 lakes, monthend contents for 26 lakes and reservoirs, water-quality data for 9 gaging stations, and water levels for 40 observation wells. Also included are data for 18 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. A few pertinent stations (not included above) in bordering States and Province of Quebec are also included in this report. These data represent that portion of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in New Hampshire and Vermont. (USGS)
W81-02467

WATER RESOURCES DATA FOR MISSISSIPPI, WATER YEAR 1979.
Geological Survey, Jackson, MS. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-176331, Price codes: A19 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MS-79-1, February, 1981. 438 p, 5 Fig.

Descriptors: *Mississippi, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for Mississippi consist of records of stage and discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels of wells. This report contains discharge records for 80 gaging stations, stage records for 17 of these gaging stations, stage only for

3 gaging stations, contents for 4 lakes, water quality for 25 gaging stations and 162 wells, and water levels for 360 observation wells. Also included are data for 94 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Mississippi. (USGS)
W81-02468

WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1980--VOLUME 1. CENTRAL AND NORTHERN LOUISIANA.
Geological Survey, Baton Rouge, LA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-171621, Price codes: A23 in paper copy, A01 in microfiche. Geological Survey Water-Data Report LA-80-1, December, 1980. 526 p, 7 Fig.

Descriptors: *Louisiana, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Central and northern Louisiana.

Water resources data for the 1980 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of groundwater. This report, in three volumes, contains records for water discharge at 75 gaging stations (including stage for 71 of these stations); stage only for 38 gaging stations and 11 lakes; contents for 1 reservoir; water quality for 124 surface-water stations (including 34 gaging stations, 107 miscellaneous sites, and 15 lakes), and 268 wells; and water levels for 506 observation wells. Also included are data for 271 crest-stage and flood-profile partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States are also included in this report. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal Agencies in Louisiana. (USGS)
W81-02469

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1979--VOLUME 4. NORTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM HONEY LAKE BASIN TO OREGON STATE LINE.
Geological Survey, Menlo Park, CA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-163966, Price codes: A22 in paper copy, A01 in microfiche. Geological Survey Water Data Report CA-79-4, January, 1981. 505 p, 12 Fig.

Descriptors: *California, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Northern central valley basins, Honey Lake basin(CA), *Sacramento River basin(CA).

Volume 4 of the water resources data for the 1979 water year for California consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality in lakes and reservoirs; and water levels in wells. This report contains discharge records for 204 gaging stations, stage and contents for 34 lakes and reservoirs, precipitation data for 2 stations, water quality for 81 stations, water levels for 33 observation wells, and water quality for 15 wells. Also included are 16 crest-stage partial-record stations, 9 low-flow partial-record stations, and 4 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as special investigations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (USGS)
W81-02470

A COMPILATION OF GROUNDWATER QUALITY DATA FOR KENTUCKY.
Geological Survey, Louisville, KY. Water Resources Div.
Geological Survey Open-File Report 80-685, May, 1980. 963 p, 1 Fig, 8 Tab, 16 Ref. Faust, R. J., Banfield, G. R., and Willinger, G. A., compilers.

Descriptors: *Groundwater, *Water quality, *Chemical analysis, *Hydrologic data, *Kentucky, Analytical techniques, Geology, Water properties, Water utilization.

This report provides most of the data in the files of the U.S. Geological Survey on the quality of groundwater in Kentucky. All analyses through 1979 are included except for some special purpose repetitive analyses and some with a very limited number of constituents. County location maps are included with the analyses. These include location, distribution, and density of sampling sites in each county. Most of the data in this report resulted from cooperative studies made with the Kentucky Geological Survey and with other Federal, State, and local agencies. (USGS)
W81-02475

SUMMARY OF STREAMFLOW IN JEFFERSON COUNTY, ALABAMA,
Geological Survey of Alabama, University. Water Resources Div.
R. H. Bingham, and J. D. Moore.
Alabama Geological Survey Water Resources Division, University, Atlas 16, 1980. 21 p, 13 Fig, 2 Tab, 8 Ref.

Descriptors: *Streamflow, *Flow rates, *Alabama, Natural flow, Flow characteristics, *Flow duration, Duration curves, Discharge measurement, *Jefferson County(AL).

Flow-duration curves and streamflow distribution graphs based on 11 continuous-record gaging stations show that most gaged streams in Jefferson County, Ala., are perennial and flow varies seasonally. The largest discharge occurs in the spring and the smallest discharge occurs in the fall. Locust Fork is the largest potential source of surface water supply in Jefferson County. The average discharge of Locust Fork at Sayre is 1400 cubic feet per second for 40 years of discharge data. The average discharge of Fivemile Creek at Ketona is 35.7 cubic feet per second for 8 years of discharge data. Instantaneous discharge measurements at 62 sites in Jefferson County, where three or more measurements have been made are tabulated. (USGS)
W81-02476

CHEMICAL QUALITY OF WATER FROM COMMUNITY SYSTEMS IN NEW YORK, NOVEMBER 1970 TO MAY 1975,
Geological Survey, Albany, NY. Water Resources Div.
R. H. Cartwright, and J. A. Ziarno.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-130676, Price codes: A19 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-77 1980. 444 p, 1 Fig, 3 Tab, 20 Ref.

Descriptors: *Water quality, *Chemical analysis, *Data collections, *Water supply, *New York, Sampling, Water analysis, Pesticides, Potable water.

Chemical analyses of 2,802 water samples from 784 of approximately 1,500 community water systems in the State of New York are presented. The data were collected from November 1970 to May 1975 and were originally released in a series of four U.S. Geological Survey open-file reports during the mid-1970's. The data were obtained and compiled by the Geological Survey and have been used by the State of New York in determining community system compliance with applicable drinking-water standards. The analyses include physical properties, major and minor constituents, pesticide residues, and radiochemical data. Some bottom-material analyses are included. (USGS)
W81-02477

LOW-FLOW FREQUENCY AND FLOW DURATION OF SOUTH CAROLINA STREAMS,
Geological Survey, Columbia, SC. Water Resources Div.
W. M. Bloxham.
South Carolina Water Resources Commission Report No 11, 1979. 90 p, 5 Fig, 12 Ref.

Descriptors: *Low flow, *Low-flow frequency, *Flow duration, *Streamflow, *South Carolina, Streams, Analytical techniques, Frequency analysis, Natural flow, Regulated flow, Frequency curves, Gaging stations, Sites.

Streamflow data of 71 continuous record stations in South Carolina are shown in analytical summaries. Tabulations of low-flow frequency and flow-duration data and minimum flow arrays are preceded by a description of climate and physical factors. Explanations of the variables affecting low flow and the lack of homogeneity within the State are illustrated with low-flow frequency curves from different physiographic regions. A standard period of record common to each site could not be determined. Short records were adjusted to extend the length of sampling period by correlation and moderate frequency curve extensions. Low-flow frequency estimates are based on graphical rather than mathematical curve fittings because of the deviation of computed values at low probability levels. Regulation and diversion factors are accounted for in the analyses and identified in the station descriptions. (USGS)
W81-02484

WATER RESOURCES ACTIVITIES IN ILLINOIS, 1980,
Geological Survey, Champaign, IL. Water Resources Div.
For primary bibliographic entry see Field 7A.
W81-02485

PUBLIC PERCEPTIONS IN WATER QUALITY EVALUATION,
Auburn Univ., AL.
S. H. Dinius.
Water Resources Bulletin, Vol 17, No 1, p 116-121, February, 1981. 4 Tab, 10 Ref. OWRT A-054-ALA(3), 14-34-0001-7002.

Descriptors: *Water quality, *Water management, Water pollution, Water evaluation, Color, Public participation, Public opinion, Surface waters, Evaluation.

A Visual Perception Test, consisting of photographic slides of water sites, was designed to examine laymen's water quality perceptions. The slides were taken at five water sites where the level of visual pollution was artificially altered by the investigator. Analysis of variance indicated that the water sites were evaluated differently for each of five pollution levels. Increases in water discoloration and the quality of litter were viewed as increases in level of pollution. Laymen not only evaluated visually polluted sites lower for uses such as picnicking, but they also evaluated the quality of the actual water lower. Stepwise multiple regression indicated that a combination of water color, scenic beauty appreciation, quality of the surrounding environment and industry as a pollution source explained 73% of the variance in predicting Overall Pollution. Application of factor analysis simplified the variables to an Overall Pollution Factor and a Boating Use Factor.
W81-02498

8. ENGINEERING WORKS

8A. Structures

IF THE OLD RIVER CONTROL STRUCTURE FAILS. (THE PHYSICAL AND ECONOMIC CONSEQUENCES),
Louisiana Water Resources Research Inst., Baton Rouge.
R. G. Kazmann, and D. B. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-184103, Price codes: A07 in paper copy, A01 in microfiche. Technical addenda by J.R. Harris and D.B. Johnson, Bulletin 12, September, 1980. 135 p, 3 Fig, 19 Ref, 2 Append. OWRT-A-040-LA(3).

Descriptors: *Engineering structures, *Gates, *Control structures, *River flow, *Flow control, River regulation, Bypasses, Conduits, Structures, Check structures, Barriers, Construction materials, Construction, Repairing, Structural engineering, Engineering, Flow, Flow duration, Hydraulics, Streamflow, Regulation, Mississippi River, Atchafalaya River, *Louisiana.

The Old River Control Structure (ORCS), the device that prevents the Atchafalaya River from becoming the principal distributary, the new outlet, of the Mississippi River, and located about 40 miles north of Baton Rouge, Louisiana, was almost undermined by the flood of 1973. An auxiliary structure is presently planned for construction by the Corps of Engineers near the ORCS to reduce water flow through the present damaged ORCS; however, a real immediate threat exists for a major diversion of the Mississippi and the planned auxiliary structure cost is estimated at about $200,000,000. A major flood destroying the ORCS ability to distribution between the Lower Mississippi and Atchafalaya Rivers would occur in the Basin of the latter, and result in highway/railroad bridge destruction, gas pipelines severage, and reduced industrial productivity between Baton Rouge-New Orleans (BR-NO) along the Mississippi. Dry weather following the flood would reduce discharges in the river between BR-NO, permitting Gulf of Mexico saltwater to fill the present main stem of the river. Economic impacts were evaluated, and a plan described for replacing the BR-NO potable water supply. (Zielinski-IPA)
W81-02426

SOIL AND WATER CONSERVATION STRUCTURES, HYDRAULIC MODELS AND FIELD APPLICATIONS,
Science and Education Administration, Minneapolis, MN.
F. W. Blaisdell, C. L. Anderson, and G. G. Hebaus.
Advances in Agricultural Technology AAT-NC-6, December, 1980. 35 p, 34 Fig.

Descriptors: *Model studies, *Flood control, *Hydraulic structures, Soil conservation, Water conservation, Hydraulic models, Spillways, Stilling basins, Inlets, Culverts, Hydraulic design.

Weather or impassible roads during severe storms limit opportunities to see soil and water conservation structures passing large floods. However, models of these structures can be built in the laboratory and their performance observed under simulated severe flood conditions. Pictures are shown of models and their comparable prototypes to illustrate that models reliably predict the performance of field structures, that laboratory findings can be transposed to the field, and that soil conservation structures with superior hydraulic performance can be developed from laboratory tests. Small changes in the design or construction of a structure can cause large changes in the performance of that structure. Differences between good and poor structures are frequently small, and the effect of these differences on performance usually cannot be predicted, which is why laboratory tests are necessary. Types of structures illustrated include: drop spillways, straight drop spillway stilling basin, box inlet chute spillway entrance, box inlet drop spillway, open channels, culvert and chute stilling basins, pipe spillway entrances, hood inlets, hood inlet spillway entrances, drop inlets and antivortex devices, two-way drop inlet on a steep slope, two-stage two-way drop inlet as a floodwater retarding structure, and two-way drop inlet spillway entrances. (Moore-SRC)
W81-02504

WATER-RELATED SEDIMENT PROBLEMS,
E. L. Pemberton.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 4-1, p 1-30. 44 Fig, 1 Tab.

Descriptors: *Sediments, *Sediment load, *Sediment control, *Rivers, Canals, *Water distribution(Applied), Operating costs, Diversion structures, Distribution systems, Canal design, Channel morphology, Pumping plants, Return flow, Erosion control.

The types of sediment problems encountered either at a diversion structure or throughout a water distribution system may vary in different locations, but quite often have many comparable characteristics. The variations are usually attributable to differences in river channels and river hydraulics, sediment sizes, topographic changes, geology, and soil types. With a better knowledge of sediment transport concepts and river channel characteristics, these problems can be reduced, with a corresponding reduction in operating costs. Changes in design techniques are discussed for diversion structures and canal headworks, canal and distribution systems, pumping plants, stability of natural channels to convey waste flows and return flow, and miscellaneous river channel or sediment problems. Specific problems addressed include: deposition of sediment in river channel above a diversion dam and downstream bed and bank scour; sluicing arrangement not effective in reducing sand inflow to canal; cleaning sediment deposits from canal; need for settling basin at upper end of canal; canal siphons under river channels not buried deep enough for high flood peaks; cross drainage culverts sized for flood peaks as well as sediment loads; seepage from canal with clearer water diversion; sediment deposits in intake channels; wear factor for pumping sediment-laden water; excessive scour in wasteway channels; bed and bank erosion caused by return flows; use of unstable river channels as conveyance channels; bank erosion and channel stabilization; erosive action of sediment in water; and marina entrances. (Brambley-SRC)
W81-02515

REHABILITATION OF OPEN WATER CONVEYANCE SYSTEMS,
T. R. Haider.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 6-1, p 1-54. 40 Fig, 21 Ref, 1 Append.

Descriptors: *Irrigation systems, *Irrigation engineering, *Rehabilitation, *Water conveyance, Seepage control, Linings, Canals, Check structures, Siphons, Flumes, Chutes, Turnouts, Drainage engineering, Hydraulic design, Structural design, Economics, Safety factors, Maintenance.

Rehabilitation of irrigation systems may occur because routine maintenance is no longer sufficient, or modifications are required for greater efficiency, to meet current safety standards, or for automation. The repair versus replacement costs must be considered for any structure. The canal sections may need lining to control seepage; earth, concrete, and membrane liners are discussed. The structures in an irrigation system may include check structures, inverted siphons, inline flume structures, pipe and rectangular drop and chute structures, turnout structures, cross drainage structures, drainage inlets, and bridges. Changes in the hydraulic design and/or structural design of these structures are presented, with emphasis on economics and safety standards. (Brambley-SRC)
W81-02516

CANAL LININGS AND SOIL SEALANTS,
For primary bibliographic entry see Field 3F.
W81-02517

DESIGN, INSTALLATION, AND MAINTENANCE OF PIPE SYSTEMS,
L. A. Kinney, D. R. Osmundsen, and C. Davenport.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 8-1, p 1-15. 12 Fig.

Descriptors: *Irrigation systems, *Irrigation engineering, *Piping systems(Mechanical), *Pipelines, *Hydraulic design, *Sprinkler irrigation, Hydraulic structures, Excavation, Corrosion control, Installation, Maintenance, Resistivity, Soil properties.

Greater emphasis is being placed on the use of pipeline water distribution systems by the Water and Power Resources Service. There are three types of pipe systems, low-head, open stand; low-head, closed; and high-head, sprinkler. Most new installations are of the sprinkler type and older low-head systems are being converted, to obtain more efficient water use and reduce labor costs. The types of pipe and pipe joints to be used in any system depend on the location and conditions within the system. Pipes may be rigid or flexible, each requiring different trench, bedding and backfill conditions. Any pipe containing iron must be protected from corrosion; the amount of protection depends on the type of pipe and the soil resistivity and stray currents around the pipe. Correct installation can prevent maintenance problems; some problems and their solutions are presented. (Brambley-SRC)
W81-02518

DRAINAGE OF IRRIGATED LANDS,
J. N. Christopher.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Sessions 13-1 and 13-2, p 1-9.

Descriptors: *Irrigation systems, *Drainage systems, *Drains, *Drainage engineering, *Irrigation engineering, Saline soils, Saline water, Saturated soils, Soil physical properties, Groundwater, Groundwater movement, Recharge wells, Economics, Agricultural watersheds.

Drainage of irrigated land is almost always necessary to prevent waterlogging and salinization of the soil. Both conditions kill plants, by lack of oxygen in the root zone, and by their inability to absorb nutrients and water, respectively. In planning a drainage system, the specific yield and permeability of the soil, and the location, source and characteristics of the groundwater are the most important factors for consideration. The drainage system may use open or closed drains, pumped wells, or recharge wells. Closed drains are the preferred system in most cases, having the benefits of least cost, and least loss of land. Improved methods of predicting and determining subsurface drainage requirements have produced data on groundwater position and fluctuations, drain discharge methods, and permeabilities, which have been used to compute drain spacings with improved accuracy. Drain spacing and depth are interdependent, and for given conditions there is an economically optimum combination. The benefits of a gravel envelope around drains, and manholes, junction boxes and silt traps are discussed. (Brambley-SRC)
W81-02525

8C. Hydraulic Machinery

WATER MEASUREMENT,
R. G. Karrh, J. Crist, C. R. Buyalski, and R. A. Dodge.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Sessions 3-1 and 3-2, p 1-5.

Descriptors: *Water measurement, *Instrumentation, *Flow measurement, *Discharge measurement, Flow characteristics, Water resources, Maintenance, Reliability, Forecasting, Water supply(Development), Water delivery.

Accuracy in water measurement is important in the operation of any water system, so that future needs may be defined and anticipated. Standard devices are less expensive and generate more backup data and experience. A truly standard device is one which has been fully described, accurately calibrated, correctly made or installed, and sufficiently maintained to fulfill the original measurements, so that accurate water measurements may be obtained from standard discharge tables or curves. Accurate discharges from nonstandard structures can be obtained only from specially prepared curves or tables based on calibration tests. Inaccurate measurement may derive from flow factors such as approach and exit flow conditions, turbulence, and rough water surface; from equipment factors such as poor workmanship, weathered and worn equipment, faulty head measurement; or by infrequent measurement and the use of the wrong measuring device. Some causes of these factors are discussed. (Brambley-SRC)
W81-02514

PUMP AND MOTOR MAINTENANCE,
E. M. Corless.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 14-1, p 1-4.

Descriptors: *Pumps, *Electric motors, *Switchgear, *Maintenance, Electrical equipment, Hydraulic machinery, Lubricants, Vibration, Cavitation, Inspection, Insulation, Pump testing, Water conveyance, Pumping.

A failure in any of the three components of a pump, the pump, motor or switchgear, will cause the pump to be out of service. Pumps may be maintained in good working order by use of the proper lubrication in proper amounts, use of metalized shaft sleeves with correct packing, prevention of vibration and its immediate correction when it occurs, screening to keep foreign objects out of the pump, and selection of the correct pump for the job which prevents cavitation. Low pump discharge is usually caused by excessive wear or clearance at the pump seal, and can be corrected by replacing seals, building up the impeller or machining it to the correct tolerances. A permanent record of the pump's operating history is invaluable in determining if a pump is not working properly. Electric motors and switchgears are best maintained by keeping them clean, tight, dry, and cool. For motors, regular insulation testing should be conducted, with visual inspections, and permanent records maintained. These principles also apply to transformers. All work should be attempted only when the equipment is not energized. (Brambley-SRC)
W81-02526

8D. Soil Mechanics

EARTH CONSTRUCTION PRACTICES,
C. W. Jones.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 10-1, p 1-38. 22 Fig, 1 Tab, 14 Ref.

Descriptors: *Earth materials, *Construction materials, *Foundations, *Testing procedures, *Foundation investigations, Foundation bearing tests, Soil tests, Soil classification, Soil stability, Permeability, Erosion, Soil types, Embankments, Backfill.

Test procedures have been developed for evaluating foundation and conditions, to supplement judgement on the soundness of a foundation. The extent of testing depends on the importance of the structure, the seriousness of the soil conditions, and the steps that may be necessary to solve the problem. Some initial tests on the soil and subsoil include: bearing capacity; stability; settlement and uplift; deterioration; erosion; and permeability. Some common foundation problems and possible remedial measures are presented for consolidated and compressible clays, silts and intermediate soils, and sands and gravels. In the maintenance, repair and relocation of a water system soil is frequently used as a construction material. For satisfactory construction the soil must be classified and the cause and solution of the problem determined. Specific information is given for the repair and construction of embankments, preparation of backfill, compacted earth lining and cover layers. (Brambley-SRC)
W81-02520

8F. Concrete

CONCRETE REPAIR AND MAINTENANCE,
J. R. Graham, T. Rutenbeck, and O. R. Werner.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 9-2, p 1-23. 10 Fig, 3 Ref, 1 Append.

Descriptors: *Water management, *Concrete structures, *Concrete construction, *Maintenance, *Repairing, Water distribution(Applied), Gunite, Epoxy resins, Binders, Safety, Structures.

Most structures within a water system are made of concrete, and will need maintenance and ultimately repair. Concrete deterioration and failure can result from planning, design or construction deficiencies; unforeseen natural phenomena; and natural attrition and old age. Preventive maintenance will reduce the need for repair. A guide to material and repair method selection provides a logical systematic approach for decisions regarding the extent of the failure and the methods of repair. Proper preparation of the existing concrete is one of the most important steps to making a good, serviceable repair. Shotcrete, dry-pack, and concrete replacement are the most common and widely used methods of repair. Best bond strength for conventional concrete patches will be developed when the patch is kept completely moist for at least 28 days. When circumstances preclude wet-curing of concrete, chemical bonding agents such as epoxy formulations may be used. Procedures for the use of epoxy formulations are given, with emphasis on the need for temperature control. Epoxy-bonded epoxy mortar is particularly useful in patching spalls and cracks in concrete, without using portland cement or concrete. Safe handling of epoxies is described, and a list of supplies necessary for concrete repair work is given. (Brambley-SRC)
W81-02519

8G. Materials

SELECTION OF PROTECTIVE COATINGS,
C. B. Haverland.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 11-1, p 1-8.

Descriptors: *Protective coatings, *Decision making, *Paints, *Structures, Water management, Coatings, Weathering, Deterioration, Maintenance, Coal-tar coatings, Cathodic protection, Dips, Epoxy resins, Corrosion control, Waterproofing.

Rising costs dictate an active corrosion control program from water control structures, and protective coatings often emerge as the most economical means of mitigating corrosion. One of the important steps in the process of selecting the proper coating is determining the exposure to which the coating will be subjected. The basic categories of exposure include: immersion, burial, alternate submergence, atmospheric, and chemical. When these factors are combined with information on the nature of the structure to be protected, its condition, and practical considerations, a decision on the coating may be made. Specific coatings are discussed with reference to their applicability, advantages and disadvantages. They include: coal-tar enamel; cement mortar; vinyl resin systems; coal-tar epoxy paint; hot-dip galvanizing; silicone-alkyd enamels; and neoprene, latex, portland cement, epoxy, vinyl resin, enamel, and aluminum finish paints. Regular inspection of all coatings is recommended so that maintenance or replacement needs can be forecast. In the maintenance of existing submerged or buried steel structures, repainting may be very difficult or impossible. In this case, one way of affording continued protection may be to apply cathodic protection. However, cathodic protection currents develop an alkaline environment at the metal surface which can deteriorate the bond of certain coatings. (Brambley-SRC)
W81-02521

PREPARATION AND APPLICATION OF PROTECTIVE COATINGS,
H. F. Adams.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 11-2, p 1-10.

Descriptors: *Protective coatings, *Corrosion control, *Paints, *Maintenance, Structures, Surfaces, Coatings, Economics, Cleaning, Abrasive blasting, Curing.

Correctly selected and applied coatings serve longer and require less maintenance, reducing the long-term coating costs. Preparation of the base surface, mixing or other preparation of the paint, and application to the surface are discussed in the light of maintenance conditions and primarily with respect to metal. Practical maintenance problems include timing to obtain satisfactory temperatures, ventilation, humidity control, and safety practices, particularly when dealing with new products. Surface preparation may require the removal of foreign substances from the surface, removal of all loose materials or removal of all materials by blast cleaning. Most paints require mixing to obtain uniform consistency, but some require the addition and complete mixing of a catalyst which causes setting of the paint by a chemical reaction. Application of paint by brushing, roller, or spray will be determined by the structure, the paint and number of coats to be applied. Sufficient time must be allowed after application for curing of the paint and inspection of the work. (Brambley-SRC)
W81-02522

CATHODIC PROTECTION OF SURFACES,
H. K. Uyeda.
In: Water Systems Management Workshop, 1980, Session Notes, Department of the Interior, Water and Power Resources Service, Session 11-3, p 1-10.

Descriptors: *Cathodic protection, *Corrosion control, *Metals, *Surfaces, Electrolytes, Cost-benefit analysis, Anodes, Cathodes, Structures, Water loss, Electrolysis, *Pipelines.

Cathodic protection is the reduction or elimination of corrosion of a metal by making current flow to it from an electrolyte. Both galvanic or local cell corrosion and electrolytic or stray-current corrosion may be controlled. In the galvanic anode method, corrosion is controlled by purposely creating a corrosion cell by use of a bimetallic couple, in which the anode corrodes, saving the structure planned as the cathode. In the impressed current method anodes are used which are energized by an external, direct-current power source. Each method has characteristics which make it more applicable to particular situations than the other. Successful cathodic protection requires a suitable continuous electrolyte common to both the anode and the structure, a method of making current flow in the desired direction, and a method of getting sufficient current to every point on the surface of the structure. Each system is a special case which requires thorough preliminary testing, but a structure-to-electrolyte potential of -0.85 volt or more is recommended. The cost of installing cathodic protection varies with the structure, the system and the direct and indirect costs assigned to the consequences of corrosion. (Brambley-SRC)
W81-02523

8I. Fisheries Engineering

A SIMPLE IN SITU METHOD FOR MEASURING BENTHIC RESPIRATION,
Ministry of Agriculture, Tiberias (Israel). Unit for Applied Research in Intensive Fish Culture.
For primary bibliographic entry see Field 2H.
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ANALYSIS AND DISSEMINATION OF WATER QUALITY AND WATER QUANTITY DATA,
South Dakota State Univ., Brookings. Water Resources Inst.
For primary bibliographic entry see Field 7C.
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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 14, NUMBER 14
JULY 15, 1981

W81-02651 -- W81-02900
CODEN: SWRABW

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

VOLUME 14, NUMBER 14
JULY 15, 1981

W81-02651 -- W81-02900

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Office of Water Research and Technology. The cumlative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

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04 WATER QUANTITY MANAGEMENT AND CONTROL

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06 WATER RESOURCES PLANNING

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07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

THE STRUCTURE OF HYDROCHEMICAL FIELDS AND SHORT-TERM PREDICTION,
Gidrokhimicheskii Inst., Rostov-na-Donu (USSR).
A. M. Nikanorov, B. M. Vladimirskiy, V. L. Pavelko, Y. V. Melniko, and K. L. Botsenyuk.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche.
In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, Aug 27-30, 79, Bloomfield Hills, MI. EPA Report 600/9-80-033, Jul 80. p 156-179, 4 Fig, 9 Tab, 7 Ref.

Descriptors: *Mathematical models, *Prediction, *Chemical properties, Anions, Cations, *Volga River(USSR), Mathematical studies, Reservoirs, Tributaries, Regression analysis, Factor analysis, Russia.

Empirical models are necessary to predict phenomena which do not have a theoretical interpretation. Analysis of the structure of hydrochemical fields and the resulting empirical descriptions are inseparably related both to the points of measurement selected and to the mathematical apparatus used. Some 30,000 previously published results of hydrochemical indices in reservoirs along the Volga River and its tributaries were used in factor and regression analyses. It was found that by selecting the concentration of calcium and bicarbonate ions, it was possible to predict four other variables-magnesium and chloride ions, the sum of ions, and total hardness. Parameters of the empirical models are determined which can be used to make the transition from integral charcteristics to particular characteristics for a predetermined point so that the spatial structure of the hydrochemical field may be determined. The methods of analysis suggested do not contradict the concept of the field used in hydrochemistry, and can be used in the prediction of space-time characteristics of hydrochemical indices, providing optimization of the network, with respect to spatial parameters and to time. (Brambley-SRC)
W81-02738

2B. Precipitation

PRELIMINARY ANALYSIS OF REGIONAL-PRECIPITATION PERIODICITY,
Geological Survey, Lawrence, KS. Water Resources Div.
C. A. Perry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-161630, Price codes: A03 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations 80-74, September 1980. 26 p, 9 Fig, 22 Ref.

Descriptors: *Precipitation(Atmospheric), *Hydrologic cycle, *Droughts, *Climatology, *Meteorology, Time series analysis, Regional analysis, Magnetic studies, Variability, Cycles, Precipitation periodicity, Solar-weather interrelationships.

Precipitation variability plays a major role in nearly every aspect of the hydrologic cycle. Precipitation is not a random event, but it occurs after a sequence of prerequisites has been fulfilled. Recent investigations have shown that activity of the sun can affect atmospheric vorticity, an important factor in precipitation formation. Solar activity is known to be periodic; therefore, through a complex series of physical processes, precipitation variance is solar forced to a certain degree. A preliminary analysis of precipitation periodicity was made for eight regions scattered across the central United States. Each region contained 5 to 10 stations with long-term precipitation records that were averaged to obtain yearly regional-precipitation values. Graphic analysis shows 11-year and 22-year cycles that are nearly in phase with the solar cycles. An example of the effect of cyclic precipitation is presented for the Powder River basin in Wyoming and Montana. A cycle of 22 years exhibits fluctuations of approximately 22 to 27% for precipitation and 38 to 50% for runoff. A more detailed study that investigates solar-forced precipitation cycles and their relationship to hydrologic processes is needed. (USGS)
W81-02687

ANALYSES OF SOUTH AFRICAN RAINFALL,
Commonwealth Scientific and Industrial Research Organization, South Melbourne (Australia). Div. of Chemical Technology.
R. G. Vines.
South African Journal of Science, Vol 76, No 9, p 404-409, September, 1980. 10 Fig, 16 Ref.

Descriptors: *Rainfall, *Sunspots, *South Africa, *Cycles, Precipitation, Droughts, Weather, Australia, New Zealand, Tasmania, Forecasting, Weather forecasting.

Filter analysis of South African rainfall data in the south and northeast shows quasi-periodic fluctuations of 16-20, 10-12, and 6-7 years. The 16-20 and 6-7 year cycles are common to the whole country, but the 10-12 year wave in the south is out of phase with the northeast. Comparisons with precipitation data (some as far back as 1895) for southeast Australia, Tasmania, and New Zealand suggests correlation with the 10-12 year sunspot cycle. The results of the present analysis are in accord with Tyson and Dyer's estimate of the likelihood of extending drought conditions over much of South Africa in the mid 1980's. Although it is possible to suggest only broad estimates of future trends, even crude estimates could be useful for some planning purposes. (Cassar-FRC)
W81-02873

2E. Streamflow and Runoff

STREAMFLOW STATISTICAL SUMMARIES FOR COLORADO STREAMS THROUGH SEPTEMBER 30, 1975, VOLUME 2: COLORADO RIVER BASIN ABOVE GUNNISON RIVER,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02676

USING CHANNEL GEOMETRY TO ESTIMATE FLOOD FLOWS AT UNGAGED SITES IN IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 6A.
W81-02679

PRELIMINARY ANALYSIS OF REGIONAL-PRECIPITATION PERIODICITY,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2B.
W81-02687

EVALUATION OF PEAK-FLOW DATA NETWORK OF SMALL STREAMS IN MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
L. D. Hauth.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-156242, Price codes: A03 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations 80-87, 1980. 38 p, 9 Fig, 8 Tab, 21 Ref.

Descriptors: *Peak discharge, *Small watersheds, *Missouri, *Flood frequency, Flood recurrence interval, Estimating, Regression analysis, Networks, Data collections, Stream gages, Evaluation.

Standard regression models were used as a tool to evaluate the transferability of streamflow characteristics for the small-streams network in Missouri. Station records were divided into segments and tested for adequacy of record length and sample size for two physiographic regions. The standard error of estimate for each calibrated regression model, using increasing record lengths, was compared against the longest period of record in both tests. Results of the study indicate that an increase in the length of small-area streamflow records or additional sampling sites in the data network will not substantially improve the standard error of estimate of the regression model. Therefore, it is recommended that the current (1980) crest-stage network be reduced to a sample large enough to measure the long-term trend and provide information for future capabilities in the field of small-streams hydrology. It is also recommended that additional research be carried out to determine additional variables which could be used to predict floodflows and other types of regression models. (USGS)
W81-02689

BEHAVIORAL AND CATASTROPHIC DRIFT OF INVERTEBRATES IN TWO STREAMS IN NORTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
D. J. Wangsness, and D. A. Peterson.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $1.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1101, December, 1980. 13 p, 6 Fig, 16 Ref.

Descriptors: *Invertebrates, *Streams, *Wyoming, *Aquatic drift, Mayflies, Midges, Baseflow, Runoff, Peak discharge, Powder River(WY), Clear Creek(WY), Behavioral drift, Catastrophic drift.

Invertebrate drift samples were collected in August 1977 from two streams in the Powder River structural basin in northeastern Wyoming. The streams are Clear Creek, a mountain stream, and the Little Powder River, a plains stream. Two major patterns of drift were recognized. Clear Creek was sampled during a period of normal seasonal conditions. High drift rates occurred during the night indicating a behavioral drift pattern that is related to the benthic invertebrate density and carrying capacity of the stream substrates. The mayfly genes Baetis, a common drift organism, dominated the peak periods of drift in Clear Creek. The Little Powder River has a high discharge during the study period. Midge larvae of the families Chironomidae and Ceratopogonidae, ususally not common in drift, dominated the drift community. The dominance of midge larvae, the presence of several other organisms not common in drift, and the high discharge during the study period caused a catastrophic drift pattern. (USGS)
W81-02702

DEVELOPMENT OF A STREAMFLOW FORECASTING PROCEDURE FOR INTERMOUNTAIN BASINS,
Montana State Univ., Bozeman. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W81-02726

FLOOD FREQUENCY MODELING AND OUTLIERS,
Illinois State Water Survey, Urbana.
K. P. Singh.
In: Proceedings of the Specialty Conference on Computer and Physical Modeling in Hydraulic Engineering, ASCE/August 6-8, 1980, Chicago. p 74-85 (1980). 10 Ref.

Descriptors: *Illinois, *Flood frequency, *Standard deviation, *Statistical methods, Flood flow, Flood data, Flood profiles, Flood recurrence interval, Flood forecasting, Flood basins, Flood peak, Model studies, Flood plains.

The U.S. Water Resources Council recommends a methodology to promote uniform, consistent and accurate techniques for determining flood-flow frequency. Using the Sangamon River basin in central Illinois to illustrate the effects of various factors on flood frequencies, this report analyzes the Council's procedure with emphasis on the detection of outliers---the observations in a set of data that

appear to be inconsistent with the remainder of the data. The report concludes that the criterion for low flood outliers is too severe, resulting in low values (algebraically) of skew. A methodology is developed and applied to modify low and/or high outliers; statistics of storms producing floods perceived as high outliers, and the associated antecedent soil moisture conditions, can be used for confirming high outliers. It is suggested that the Council's methodology for regionalization of skew values can be more precise and meaningful if the outliers are modified before analyzing the flood series. The statistically best plotting position was found to be superior to the Weibull plotting position for testing the goodness of fit of the derived flood distribution curve and the observed floods. (Garrison-Omniplan)
W81-02803

SOME ECOLOGICAL OBSERVATIONS ON ENVIRONMENTAL PARAMETERS, PLANKTONIC SEASONAL SUCCESSION AND BIOMASS IN RIO CRUCES (PROV. VALDIVIA), SOUTH CHILE,
Giessen Univ. (Germany, F.R.). Inst. fuer Pflanzenoekologie.
For primary bibliographic entry see Field 5C.
W81-02876

2F. Groundwater

SURFICIAL GEOLOGY OF NEW HAVEN QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Syracuse Univ., NY.
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SURFICIAL GEOLOGY OF ORWELL QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
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SURFICIAL GEOLOGY OF MEXICO QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Syracuse Univ., NY.
For primary bibliographic entry see Field 7C.
W81-02671

GROUND-WATER QUALITY AND DATA ON WELLS AND SPRINGS IN PENNSYLVANIA, VOLUME I--OHIO AND ST. LAWRENCE RIVER BASINS,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02675

SELECTED WATER-LEVEL RECORDS FOR OKLAHOMA, 1979-80,
Geological Survey, Oklahoma City, OK. Water Resources Div.
W. B. Mills, and D. E. Spiser.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $7.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-975, November 1980. 55 p, 1 Fig, 1 Tab.

Descriptors: *Oklahoma, *Water wells, *Water levels, *Aquifers, Water levels fluctuations, Basic data collections.

A systematic program to collect water-level records in Oklahoma began in 1937. The objectives of this program are (1) to provide long-term records of water-level fluctuations in representative wells, (2) to facilitate the prediction of water-level trends and indicate future availability of groundwater supplies, and (3) to provide information for use in basic research. This report includes water-level data from wells measured annually, prior to the irrigation season, to achieve the most natural representation of the static water level; and the counties and number of wells there in, where data were obtained.
W81-02683

GEOHYDROLOGY OF THE DELTA-CLEARWATER AREA, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
D. E. Wilcox.
Geological Survey Water-Resources Investigations 80-92, 1980. 26 p, 13 Fig, 4 Tab, 14 Ref.

Descriptors: *Hydrogeology, *Groundwater, *Aquifers, *Surface-groundwater relationships, *Alaska, Areal hydrogeology, Aquifer characteristics, Water levels, Potentiometric level, Groundwater recharge, Groundwater movement, Water wells, Water yield, Influent streams, Discharge(Water), Water quality, Planning, Hydrographs, *Delta-Clearwater area.

The alluvial aquifer in the Delta-Clearwater area, Alaska, is composed of lenticular, interbedded deposits of silt, sand, and gravel. Ground water occurs under both confined and unconfined conditions in the area. The potentiometric surface slopes approximately northward at gradients ranging from about 1 to 25 feet per mile. The aquifer is recharge by seepage through the streambeds of rivers and creeks and by infiltration of precipitation. Water is discharged from the aquifer into the Clearwater Creek network and Clearwater Lake, which are almost entirely spring-fed, at the mouth of the Delta River, and into the Tanana River along the northern boundary of the study area. Year-round ground-water discharge from the aquifer is estimated to exceed 1,200 cubic feet per second. The following ground-water flow system is hypothesized: Channel losses from the Gerstle River, several small creeks draining the Alaska Range, and the Tanana River to the east of Clearwater Creek recharge the sections of the aquifer discharging at the Clearwater Creek network. Channel losses from the Delta River and Jarvis Creek are the main source of recharge to the sections of the aquifer discharging in the vicinity of Clearwater Lake and Big Delta. Additional work is needed to verify these hypotheses. (USGS)
W81-02688

SEAWATER INTRUSION AND POTENTIAL YIELD OF AQUIFERS IN THE SOQUEL-APTOS AREA, SANTA CRUZ COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-02690

GROUNDWATER HYDROLOGY OF JAMES CITY COUNTY, VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
J. F. Harsh.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO. 80225, Price: $21.25 in paper copy, $5.50 in microfiche. Geological Survey Open-File Report 80-961 (WRI), September, 1980. 73 p, 22 Fig, 4 Plates, 6 Tab, 32 Ref.

Descriptors: *Groundwater resources, *Sand aquifers, *Aquifer characteristics, *Coastal Plains, *Virginia, Hydrogeology, Groundwater availability, Groundwater movement, Potentiometric level, Water quality, Saline water-freshwater interfaces, Water resources development, *James City County.

Urbanization and increase in water demand prompted a 2-year study of groundwater availability and quality in the county of James City. The coastal-plain sediments, parts of which underlie the county, are the largest source of groundwater in Virginia. Four aquifers form the complex aquifer system. Hydraulic characteristics vary from aquifer to aquifer and from place to place. The Cretaceous aquifer furnishes nearly all the water for industrial and municipal needs. Movement of water in the Cretaceous aquifer is toward cones of depression formed by pumping centers at Williamsburg and Dow Badische Co. All aquifers contain water that generally meets State standards for drinking water. Water in the Cretaceous aquifer is of the sodium chloride bicarbonate type. As depth of aquifer increases, the concentrations of dissolved solids and chloride also increase. Saline water (more than 250 milligrams per liter) occupies the deeper parts of the confined aquifers. The amount of water stored in the coastal sediments is estimated to be 650-1300 billion gallons. An increase in pumpage to accomodate the expected daily demand of 9.8 million gallons per day in year 2000 is feasible provided pumpage is distributed over the county. (USGS)
W81-02695

APPRAISAL OF GROUND-WATER RESOUCES IN THE SAN ANTONIO CREEK VALLEY, SANTA BARBARA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 6D.
W81-02700

RELATIONSHIPS BETWEEN BASIC SOILS-ENGINEERING EQUATIONS AND BASIC GROUND-WATER FLOW EQUATIONS,
Geological Survey, Lawrence, KS. Water Resources Div.
D. G. Jorgensen.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.50. Geological Survey Water-Supply Paper 2064, 1980. 40 p, 9 Fig, 1 Tab, 41 Ref.

Descriptors: Groundwater, *Soil engineering, *Equations, *Groundwater movement, Porosity, Void ratio, Compressibility, Consolidation, Storage, Soil compaction, Hydraulic conductivity, Unsteady flow, Modulus of elasticity.

Equations for the Terzaghi theory of consolidation and equations for ground-water flow are identical under specific conditions. A combination of the two sets of equations relates porosity to void ratio, and relates the modulus of elasticity to the coefficient of compressibility, coefficient of volume compressibility, compression index, coefficient of consolidation, specific storage, and ultimate compaction. Also transient ground-water flow is related to coefficient of consolidation, rate of soil compaction, and hydraulic conductivity. Examples show that soils engineering data and concepts are useful to solution of problems in ground-water hydrology. The many varied but related terms developed by ground-water hydrologists and soils engineers are useful to each discipline, but the difference in concepts hinders the use of related terms in interdisciplinary studies. (USGS)
W81-02708

2G. Water In Soils

RELATIONSHIPS BETWEEN BASIC SOILS-ENGINEERING EQUATIONS AND BASIC GROUND-WATER FLOW EQUATIONS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02708

AIRCRAFT REMOTE SENSING OF SOIL MOISTURE AND HYDROLOGIC PARAMETERS, CHICKASHA, OKLA., AND RIESEL, TEX., 1978 DATA REPORT,
Science and Education Administration, Beltsville, MD. Hydrology Lab.
T. J. Jackson, T. J. Schmugge, G. C. Coleman, C. Richardson, and A. Chang.
Agricultural Research Results ARR-NE-8, August 1980. 52 p, 18 Fig, 29 Tab, 1 Append.

Descriptors: *Remote sensing, *Soil water, *Aerial photography, *Infrared imagery, Rainfall, Semiarid lands, Data acquisition, Soil moisture retention.

Experiments were designed and conducted to develop a data set for the analysis of relationships between remote sensing data and hydrologic variables and parameters. The data were collected on May 1, 12, and 30, 1978 in two semiarid areas, Chickasha, Oklahoma and Riesel, Texas. The NASA 929 aircraft was the sensor platform used in these experiments. A nominal altitude of 305 m and a ground speed of 278 km/hour were chosen. The systems used were: color infrared photography, a modular multispectral scanner, a thermal infrared radiometer, multifrequency microwave radiometers, (a passive microwave scanner and multifrequency active microwave scatterometers). Ground observations of soil moisture, pan evaporation, daily maximum and minimum temperatures, and daily rainfall were made in both areas. This particular series was considered successful. However, additional experiments are needed to cover a wider range of soil moisture conditions within semiarid areas. (Moore-SRC)
W81-02782

2H. Lakes

RESULTS OF A JOINT USA/USSR HYDRODYNAMIC MODELING PROJECT FOR LAKE BAIKAL,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
J. F. Paul, A. B. Gorstko, and A. A. Matveyev.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche.
In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Mangement, August 27-30, 1979, Bloomfield Hills, Michigan. Environmental Protection Agency Report 600/9-80-033, July 1980. p 129-155, 1

Descriptors: *Water circulation, *Hydrodynamics, *Suspended solids, *Dissolved solids, Turbulent flow, Water currents, Wind-driven currents, International agreements, Phosphates, *Mathematical models, Lake Baikal, *Russia.

Project 02.02-12, Protection and Management of Water Quality in Lakes and Estuaries, was initiated as part of the USA/USSR Agreement on Cooperation in the Field of Environmental Protection of 1972. Scientists of the two countries compared formulations and results of hydrodynamic and transport models to provide a basis for further verification of lakewide and nearshore models. The model developed has two components, the basic hydrodynamic calculation and the dispersion of dissolved and/or suspended material. The equations for the hydrodynamic component are derived from the time-dependent, three-dimensional equations for conservation of mass, momentum, and energy. The transport and dispersion of material in the turbulent flow is described in a manner similar to that used for the transport and turbulent dispersion of heat and momentum. Surface currents are calculated in relation to wind direction; the model was in good agreement with observed values. Using the steady-state currents that were calculated, the transport and dispersion of phosphate ion and total suspended solids were calculated for each of the four main wind directions. The calculated distributions were in general agreement with observed data. (Brambley-SRC)
W81-02737

A MULTI-LAYERED NESTED GRID MODEL OF LAKE SUPERIOR,
Minnesota Univ., Duluth. Dept. of Physics.
G. J. Oman, and M. Sydor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche.
In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models of Optimize Water Quality Management, August 27-30, 1979, Bloomfield Hills, MI. EPA Report 600/9-80-033, July, 1980. p 207-236, 15 Fig, 42 Ref, 1 Append.

Descriptors: *Mathematical models, *Lake Superior, *Water circulation, Lakes, Hydrological models, Limnology, Model studies, *Bathymetry, Thermal stratification, Remote sensing, Satellite technology.

The size and complex bathymetry of Lake Superior pose serious obstacles when attempting to understand lake dynamics. An understanding of the physical processes occurring in Lake Superior will probably best be achieved by means of numerical modeling in conjunction with remote sensing data and direct measurements made on the lake. Existing three-dimensional Great Lakes models were reviewed to find an appropriate model for Lake Superior. The decision was made to first develop and verify an isothermal model before dealing with the much more difficult task of simulating stratified flows. The Lake Superior model is similar to Leendertse's estuary model. It ignores vertical accelerations and assumes pressure varies hydrostatically. It has a free surface, and uses constant eddy coefficients to represent vertical and horizontal diffusion. Horizontal and vertical advection of momentum are represented using an energy conserving formulation. Centered space differences are used for all terms. In order to assure adequate spatial solution in regions of interest, a nested grid model is used. The complex bathymetry and highly variable thermal structure of Lake Superior can be handled more conveniently with layers of fixed depth, letting only the bottom layer vary in thickness. The model was run for 24 hour periods for easterly and westerly winds on Lake Superior, and on a 2.5 km nested subgrid in extreme western Lake Superior. Results are consistent with Landsat observations. (Moore-SRC)
W81-02741

A SEGMENTED MODEL OF THE DYNAMICS OF THE ECOSYSTEM OF LAKE BAIKAL CONSIDERING THREE-DIMENSIONAL CIRCULATION OF THE WATER,
Akademiya Nauk SSSR, Leningrad. Inst. Evolyutsionnoi Fiziologii i Biokhimii.
V. V. Menshutkin, O. M. Kozhova, L. Y. Ashchepkova, and V. A. Krotova.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche.
In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, Aug 27-30, 79, Bloomfield Hills, MI. EPA Report 600/9-80-033, Jul 80, p 366-378. 5 Fig, 15 Ref.

Descriptors: *Aquatic environment, *Model studies, *Seasonal distribution, *Ecosystems, *Lakes Hydrologic systems, Phytoplankton, Zooplankton, Water circulation, Bacteria, Nutrients, Detritus, Mathematical models, Solar radiation, Water temperature, Organic matter, Water quality, Lake Baikal, *Russia.

A model of the seasonal dynamics of the pelagic ecosystem of Lake Baikal, USSR, is described, the main components of which are the phytoplankton, zooplankton, bacteria, nutrients and detritus. The surface of the lake is arbitrarily divided into 65 areas of equal size, and the volumes of water divided into two zones: the photosynthetic and destructive zones. The input functions of time include absorbed solar radiation, water temperature, and the inputs of organic matter from the largest sources of the lake. In calculating the status vector of an ecosystem, biologic and hydrologic processes are considered in each step. The redistribution of dissolved and suspended matter within the mass of water is performed in the model by means of horizontal advection and vertical turbulent mixing. The speed and direction of horizontal transfer in each region are constant throughout the year and correspond to the overall system of water circulation in the lake. The turbulent flows are proportional to the vertical gradients of matter. On the whole, the dynamics of spatial distribution of plankton demonstrated by the model agree well with the data of actual surveys made in Lake Baikal. One major advantage of the model is the fact that it enables the tracing of the path of propagation of matter entering the lake, and considers its transformation in the biological system. (Moore-SRC)
W81-02747

A TWO-MODE FREE-SURFACE NUMERICAL MODEL FOR THE THREE-DIMENSIONAL TIME-DEPENDENT CURRENTS IN LARGE LAKES,
Case Western Reserve Univ., Cleveland, OH.
Y. P. Sheng, and W. Lick.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-197809, Price codes: A04 in paper copy, A01 in microfiche.
Environmental Protection Agency Report EPA-600/3-80-047, May 1980. 70 p, 29 Fig, 34 Ref, 2 Append. R-803704.

Descriptors: *Model studies, *Mathematical models, *Water currents, *Lake Erie, Vertical flow, Wind-driven currents, Prediction, Free-surfaces, Mathematical analysis, Hydrologic models.

Since Lake Erie is the shallowest of the Great Lakes, the effects of vertical diffusion and bottom shear stress are more pronounced than in the other

Great Lakes. The numerical stability criterion associated with the vertical diffusion terms in the governing equations is also much more stringent. To resolve this problem a two-mode, free-surface model based on vertically-stretched coordinates and a vertically-implicit scheme has been developed and applied to Lake Erie under non-stratified conditions. A brief description of the general equations and boundary conditions is first given. The detailed equations for a two-mode, free-surface model are then described. Finite-difference procedures including the finite-difference equations are listed in detail. The model is first applied to idealized basins and then to Lake Erie for two wind conditions; a uniform wind suddenly imposed, and an actual wind variable in both space and time. The results of the computations are compared with the results from a single-mode, free-surface model and from a rigid-lid model. The surface elevations compare well with those computed by a single-mode free-surface model. The currents as predicted by the rigid-lid model are generally smaller than those predicted by the free-surface model. The present model requires more computer time than does a rigid-lid model but less than a single-mode free-surface model, and is superior to the rigid-lid model in that it does not eliminate currents associated with free-surface oscillations. (Brambley-SRC)
W81-02778

PHYSICAL, CHEMICAL, AND BIOLOGICAL CHARACTERISTICS OF LAKE ELLYN SEDIMENTS.
Illinois State Water Survey, Urbana.
Progress Report to the Northeastern Illinois Planning Commission, SWS Contract Report 243, (1980) 20 p, 1 Fig, 11 Tab, 4 Ref.

Descriptors: *Illinois, *Lake sediments, *Water analysis, Chemical analysis, Macroinvertebrates, Chemical sludge, Sediment yield, Lake soils, Storm runoff, Storm drainage, Storm water, Urban runoff, Surface runoff, Heavy metals, Chemical properties, Physical properties, Biological properties.

As part of the major efforts undertaken by the Northeastern Illinois Planning Commission under the National Urban Runoff Program to evaluate the water quality effects of storm water detention storage, the Water Quality Section of the Illinois State Water Survey carried out field and laboratory investigations to characterize the physical, chemical, and biological nature of the bottom sediments of Lake Ellyn. Five field sampling trips during 1979-1980, and subsequent laboratory analyses, provided the following results. In the physical characteristics category, sediment moisture content at station No 1 was found to be the lowest, progressively increasing toward the outlet; the volatile fraction of the solids was the highest at the inlet, but decreased progressively toward the outlet. No discernible trend in particle size distribution was found. For chemical characteristics, concentrations of chromium, copper, iron, lead, mercury and zinc were found in all sediment samples, as determined by atomic absorption spectroscopy. Arsenic and chromium concentrations were determined by the Inductively Coupled Plasma (ICP) method. The report also lists pH, various forms of nitrogen, total phosphorus, and grease and oil found in the sediments. Under biological characteristics, the predominant benthic organisms in Lake Ellyn were found to be Chaoborus and Chironomidae, which are essentially pollution-tolerant. (Garrison-Omniplan)
W81-02793

TURNOVER RATE OF DISSOLVED ORGANIC MATERIALS IN GLACIALLY-OLIGOTROPHIC AND DYSTROPHIC LAKES IN BRITISH COLUMBIA, CANADA,
Tsukuba Univ., Ibaraki (Japan). Inst. of Biological Sciences.
H. Seki, K. S. Shortreed, and J. G. Stockner.
Archiv fur Hydrobiolgie, Vol 90, No 2, p 210-216, October, 1980. 1 Fig, 2 Tab, 11 Ref.

Descriptors: *Oligotrophy, *Organic matter, *Lakes, Dystrophy, Trophic level, Eutrophication, Lake stages, Canada, *British Columbia.

Glacial and dystrophic lakes located in British Columbia were used to study the dynamics of dissolved organic materials. The study was conducted during the summer stratification period in 1979. All the lakes studied had low levels of one or more of the basic algal nutrients. Common features of rapid flushing, low base nutrient load and weak stratification with deep mixing throughout the year have contributed to the lakes' oligotrophic status. In dystrophic Lowe and Bonilla lakes the concentrations of both nitrogen and phosphorus are low, and distinct summer depletion of epilimnetic nitrogen occurred. In the surface of all glacial and dystrophic lakes, freshwater microorganisms with an optimum activity of 0.5% salinity were predominant, even though microorganisms in the glacial lakes showed a more euryhaline characteristic than those in the dystrophic lakes. The concentrations of amino acids and carbohydrates in situ in the lakes were mostly one order of magnitude lower than those in eutrophic watermasses, but those of organic acids were of almost the same level as those in eutrophic watermasses. (Baker-FRC)
W81-02806

INTERACTIONS OF LIGHT AND NITROGEN SOURCE AMONG PLANKTONIC BLUE-GREEN ALGAE,
Alabama Univ., University. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W81-02807

MOLECULAR WEIGHT DISTRIBUTION AND CHARACTERIZATION OF DISSOLVED ORGANIC MATTER FROM LAKE WATERS,
Nagoya Univ. (Japan). Water Research Inst.
T. Hama, and N. Handa.
Archiv fur Hydrobiologie, Vol 90, No 1, p 106-120, September, 1980. 5 Fig, 4 Tab, 41 Ref.

Descriptors: *Lakes, *Organic matter, Carbohydrates, Amino acids, Proteins, Solutes, Dissolved organic carbon, *Japan.

The molecular weight distributions of dissolved organic carbon (DOC), dissolved carbohydrates, amino acids, proteins, and organic acids in samples from three lakes in Japan were investigated with the aid of Sephadex G-25 gel filtration. DOC consisted to a considerable extent of low molecular weight organic materials in all of the water samples studied. Carbohydrates consisted of mainly high molecular weight polymers, while amino acids and proteins were distributed evenly in low through high molecular weight fractions, without any dramatic change in the concentration. Volatile organic acids were only found in the low molecular weight fraction. These organic compounds accounted for 16.5-20.6% of the DOC, thus more than 80% of the DOC was left undetermined. (Baker-FRC)
W81-02877

THE MACROBENTHOS OF LAKES ROTOROA AND ROTOITI, SOUTH ISLAND, NEW ZELAND, WITH SPECIAL REFERENCE TO THE INFLUENCE OF ALLOCHTHONOUS ORGANIC DETRITUS,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
B. V. Timms.
Archiv fur Hydrobiologie, Vol 90, No 2, p 182-196, October, 1980. 4 Fig, 4 Tab, 24 Ref.

Descriptors: *Benthos, *Lakes, Lake Rotoroa, Lake Rotoiti, *New Zealand, Decomposing organic matter, Distribution patterns, Glacial lakes, Mesotrophy, Aquatic productivity.

The mesotrophic glacial lakes, Lakes Rotoroa and Rotoiti, have substrates enriched at their southern inflow ends by natural allochthonous organic debris. Twenty macrobenthic species were found in Lake Rotoroa and 25 in Lake Rotoiti. The following species were numerous in both lakes: Lumbriculus variegatus, Limnodrilus hoffmeisteri, Phreodrilus spp., Macropelopia spp., Chironomus spp., Potamopyrgus antipodarum, and Sphaerium novaezealandiae. It is suggested that this low number of different species is largely caused by a combination of zoogeographic isolation and the lack of distinct seasonal markers in a climate background known for its vagrancies, thereby providing few reliable environmental cues. Standing crops were unexpectedly high in each lake, but particularly so in Lake Rotoroa, for lakes considered to be mesotrophic. Observation of the area would suggest that there is considerable natural input of organic detritus, mainly beech leaves and twigs. (Baker-FRC)
W81-02880

RELATIONSHIP BETWEEN HETEROTROPHIC BACTERIA AND PHYTOPLANKTON IN LAKE MERGOZZO AND LAKE BIWA,
Kyoto Univ. (Japan). Dept. of Fisheries.
Y. Ishida, M. Nakaji, and H. Kadota.
Archiv fur Hydrobiologie, Vol 88, No 4, p 450-457, June, 1980. 4 Fig, 1 Tab, 6 Ref.

Descriptors: *Bacteria, *Lake morphology, *Lake morphometry, Hypolimnion, Eutrophication, Microorganisms, Aquatic bacteria, Limnology, Lakes, *Japan, Lake Mergozzo, Lake Biwa.

Water samples collected from various depths in Lake Mergozzo and Lake Biwa were filtered through 5 micron mesh nets, and the relationships between phytoplankton and the L-bacteria in whole water and those attached to the particles larger than 5 micron in diameter were determined. The number of L-bacteria grown on nutrient-poor medium was always considerably larger than that of H-bacteria grown on nutrient-rich medium when compared with the whole water body. Particularly in the hypolimnion, a larger percentage of L-bacteria was present in particles larger than 5 micron. The findings support the theory that the L-bacteria attach to phytoplankton and its debris and are carried by them from epilimnion to hypolimnion through metalimnion. It is also suggested that phytoplankton are significant factors in the production in lake water of bacteria, especially L-bacteria, by supplying, them with solid surface to which to attach themselves. L-bacterial populations appeared most strongly assoicated with particles larger than 5 microns. It is concluded that L-bacteria often dominate in lake waters, especially in oligotrophic lakes. (Baker-FRC)
W81-02881

2I. Water In Plants

IRRIGATION OF CROPS IN THE SOUTHEASTERN UNITED STATES, PRINCIPLES AND PRACTICE,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
For primary bibliographic entry see Field 3F.
W81-02780

2J. Erosion and Sedimentation

FIELD DATA DESCRIBING THE MOVEMENT AND STORAGE OF SEDIMENT IN THE EAST FORK RIVER, WYOMING. PART I. RIVER HYDRAULICS AND SEDIMENT TRANSPORT, 1979,
Geological Survey, Denver, CO. Water Resources Div.
W. W. Emmett, R. M. Myrick, and R. H. Meade.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $6.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1189, 1980. 43 p, 2 Fig, 19 Tab, 14 Ref.

Descriptors: *Sediment transport, Rivers, *Streamflow, *Fluvial sediments, *Wyoming, Bed load, Bed load samples, Sediment discharge, Particle size, Sedimentation rates, Stage-discharge relations, Data collections, *East Fork River(WY), Helley-Smith bedload sampler.

Bed-material gradation and water-surface slope were determined for a 3.3-kilometer reach of East Fork River, Wyo. During peak snowmelt runoff, frequent measurements of water discharge and sediment-transport rate provided data describing

the inflow and outflow of water and sediment. In spring 1979, bankfull stage was exceeded on 8 days. Maximum discharge was about 32 cubic meters per second, which has a recurrence interval of about 2 years. The median particle size of bed material is 1.28 millimeters; the 35 and 65 percentiles are represented by diameters of 0.50 and 2.88 millimeters, respectively. The average water-surface slope in the reach is 0.0007 and varies little with river stage. Bedload-transport rates ranged from a little less than 0.001 to a little more than 0.1 kilograms per meter of channel width per second. Median bedload grain size, with several exceptions, ranged from 0.4 to 1.5 millimeters. Gravel-size particles generally constituted 10 to 40% of the bedload. Suspended-sediment concentrations ranged from 6 to 95 milligrams per liter. Suspended sediment smaller than sand constited about half the measured suspended sediment, ranging from 17 to 81%. (USGS)
W81-02704

FIELD DATA DESCRIBING THE MOVEMENT AND STORAGE OF SEDIMENT IN THE EAST FORK RIVER, WYOMING. PART II. BED ELEVATIONS, 1979,
Geological Survey, Denver, CO. Water Resources Div.
R. H. Meade, R. M. Myrick, and W. W. Emmett.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $22.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1190, 1980. 171 p, 1 Fig, 42 Tab, 11 Ref.

Descriptors: *Streambeds, *Bed load, *Streamflow, *Channel erosion, *Wyoming, Scour, Sediment transport, Sediment discharge, Measurement, Data collections, *East Fork River(WY).

At 39 cross sections in a 3.3-kilometer reach of East Fork River Wyo., bed elevations were measured daily during a month-long period that included the peak snowmelt runoff. Elevations were measured at less frequent intervals for a week before and several weeks after peak runoff. Considerable scour and fill was recorded at many of the cross sections. (USGS)
W81-02705

BANK EROSION OF THE ILLINOIS RIVER,
Illinois State Water Survey, Urbana.
N. G. Bhowmik, and R. J. Schicht.
Illinois Institute of Natural Resources, Report of Investigation 92, 1980. 52 p, 27 Fig, 7 Tab, 20 Ref.

Descriptors: *Illinois, *Bank erosion, Flow velocity, *Rivers, *Stream banks, Bed sediment, Erosion control, Silting, Sedimentation, Sediment load, Waves, Wind erosion, Lake breezes, Lake sediments, Reach, *Illinois River.

As part of a 5-year study to determine the effects of increased Lake Michigan diversion on water quality of the Illinois River and on its susceptibility to additional flooding, bank erosion was investigated by making a field inspection from Joliet to Grafton. It was found, in general, that the silty, sandy, and clayey materials of these severely eroded banks should be stable against the action of tractive force and flow velocity. However, preliminary computations indicated that the banks are unstable as far as the wind-generated wave action is concerned. It is suspected that river traffic-generated wave action also has a similar effect. Extensive bed and bank material samples were collected and grain size distributions were determined. After developing plan views of twenty selected sites, the bank slopes at these reaches were determined and the stability of the banks at all twenty locations was tested and anlyzed. As far as the flow hydraulics are concerned, bank erosion will not be affected by the proposed increase in diversion. A monitoring program is outlined and future research on wave action is suggested. Bank erosion attracts public attention, reduces property value, results in permanent loss of real estate, increases stream turbidity, and accelerates the silting of reservoirs or backwater lakes along the stream course. (Garrison-Omniplan)
W81-02791

DYNAMICS OF SEDIMENT AND ORGANIC DETRITUS IN A SMALL CHALK STREAM,
Freshwater Biological Association, Dorset (England). River Lab.
J. S. Welton.
Archiv fur Hydrobiologie, Vol 90, No 2, p 162-181, October, 1980. 11 Fig, 5 Tab, 33 Ref.

Descriptors: *Detritus, *Erosion, Streams, Sediments, Nutrients, Decomposing organic matter.

A study was made of the seasonal variation in amounts of detritus present in a small chalk stream in relation to the changes in macrophyte cover and community composition. The origin of the detritus present was studied, along with the accumulation rates of detritus in different parts of the stream. The maximum discharge was noted to occur during the autumn or winter. Other marginal vegetation showed a similar seasonal pattern. Detritus volume increased by 500% over the study period, corresponding to increased marginal vegetation caused by the cessation of bankside trimming and the generally low discharges occurring in 1973 and 1974. The analysis of collected sediment showed a decrease in size during the summer as the water velocity decreased, the sand became less dominant, and the fecal material increased. A decrease was noted in the percentage of organic content as the size fraction became smaller, and the organic content was lower in winter than in summer. (Baker-FRC)
W81-02879

2K. Chemical Processes

GEOCHEMISTRY OF FLUORIDE IN THE BLACK CREEK AQUIFER SYSTEM OF HORRY AND GEORGETOWN COUNTIES, SOUTH CAROLINA--AND ITS PHYSIOLOGICAL IMPLICATIONS,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 5G.
W81-02677

SELECTED CHEMICAL QUALITY CHARACTERISTICS IN STREAMS OF KENTUCKY, 1970-75.
Geological Survey, Louisville, KY. Water Resources Div.
Geological Survey Water-Resources Investigations 79-21 (open-file report), 1980. 1 Sheet, 10 Ref. (Santos, J. F., complier).

Descriptors: *Water quality, Chemical reactions, *Streamflow, *Groundwater, *Kentucky, Data collections, Dissolved solids, Hardness(Water), Nitrates, Maps.

Generalized maps of average dissolved solids, hardness and nitrate concentrations of water in streams throughout Kentucky were prepared from data collected at more than 100 sites from 1970 to 1975. Average dissolved solids concentrations seldom exceed 250 milligrams per liter. Hardness, mostly of calcium magnesium origin, generally ranges from 60 to 180 milligrams per liter. Average nitrate concentrations exceed 2 milligrams per liter at most of the sites. (USGS)
W81-02680

SPECIES DEPENDENT MASS TRANSPORT AND CHEMICAL EQUILIBRIA: APPLICATION TO CHESAPEAKE BAY SEDIMENTS,
Manhattan Coll., Bronx, NY. Environmental Engineering and Science Program.
D. M. Di Toro.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, August 27-30, 1979, Bloomfield Hills, Michigan. Environmental Protection Agency Report EPA 600/9-80-033, July 1980. p 85-12

Descriptors: *Mass transfer, *Chemical reactions, *Bottom sediments, Anions, Cations, *Chesapeake Bay, Equilibrium, Gases, Alkalinity, Interstitial water, Mathematical analysis.

A comprehensive analysis is necessary in order to understand the interrelationships between sediments and interstitial waters, and to establish the primary controlling factors. Equations of mass balance and chemical eequilibrium are combined into a single structure for the analysis of sediment interstitial water and gas phase concentrations. For the Chesapeake Bay station analyzed it appears to be a reasonable approximation to compute the distribution of the species with the components C, H, O, and S using the requirements of chemical equilibrium, but not the nitrogen species. The gas phase-aqueous phase reactions at equilibrium correspond to the case of slow gas phase motion. For species dependent transport the computations reproduce the major features of the observed data as well as the more detailed variations of the C to N ratio and the net alkalinity. The computational framework provides the means for examining the relative impact of various mechanisms that affect net alkalinity and the other species. For more complete analysis a very comprehensive data set is required, including not only the complete interstitial water chemistry but also a detailed analysis of the sediment solid phases, with both organic material and inorganic phases characterized. (Brambley-SRC)
W81-02735

2L. Estuaries

CHEMICAL AND PHYSICAL CHARACTERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1974-SEPTEMBER 1975,
Geological Survey, Houston, TX. Water Resources Div.
W. B. Lind.
Texas Department of Water Resources Report 245, April 1980. 291 p, 13 Fig, 9 Tab, 13 Ref.

Descriptors: *Chemical properties, *Physical properties, *Water quality, *Estuaries, *Texas, Data collections, Sampling, Sites, Water analysis, Chemical analysis, Organic compounds, Inorganic compounds, Trace elements, Nutrients, Insecticides, Bacteria, Coliforms, Chlorophyll.

Approximately 290 data-collection sites were visited in estuaries of Texas during the 1975 water year. At each data-collection site, field data are collected from several points along a vertical. Samples for laboratory analyses are collected from a predetermined number of data-collection sites and at other sites in the network when significant changes in field data indicate a need for additional samples. Properties or constituents measured in the field are dissolved oxygen, specific conductance, temperature, pH, transparency by Secchi disk, and turbidity. Laboratory analyses include the principal inorganic ions, biochemical oxygen demand, phenols, total organic carbon, dissolved organic carbon, suspended organic carbon, chlorophyll, coliform and streptococci bacteria, insecticides and herbicides, ammonium, nitrite, nitrate, ortho and total phosphate, and other selected ions such as aluminum, arsenic, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, nickel, strontium, and zinc. (USGS)
W81-02684

VEGETATIVE PROPAGATION OF SOME SAPROLEGNIACEAE UNDER SIMULATED-ESTUARINE-CULTURE CONDITIONS,
North Carolina Univ. at Wilmington. Dept. of Biology.
D. E. Padgett.
Mycologia, Vol 72, No 2, p 410-415, 1980. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Fungi, *Aquatic fungi, *Estuaries, Saline water, Microbiology, Microorganisms, Laboratory tests, Vegetation propagation.

Laboratory studies of saprolegniaceous fungi demonstrated that vegetative propagation occurred under simulated estuarine salinity cycles which do not permit asexual sporulation. Mycelial macerates of Achyla americana did not infect fresh bait in a 1

to 10 ppt salinity cycle. The two isolates of A. flagellata differed in behavior. Isolate 66 produced infestation in 1 to 10 ppt cycling; Isolate 67 propagated in 0 to 10 and 3 to 12 ppt salinity. Saprolegnia parasitica infested bait in 0 to 10 and 3 to 12 regimes; Thraustotheca clavata, in 0 to 12, 3 to 15, 5 to 18 ppt cycles. Therefore, saline waters may not necessarily prevent propagation of water molds. (Cassar-FRC)
W81-02814

FACTORS INFLUENCING PARTICULATE MATTER GEOCHEMISTRY IN THE ST. LAWRENCE ESTUARY TURBIDITY MAXIMUM,
Quebec Univ., Rimouski. Dept. of Oceanographic.
C. Gobeil, B. Sundby, and N. Silverberg.
Marine Chemistry, Vol 10, No 2, p 123-140, 1981. 8 Fig, 3 Tab, 45 Ref.

Descriptors: *St. Lawrence River, *Turbidity, *Sediments, Salinity, *Estuaries, *Geochemistry, Water properties, Particulate matter.

A field study is presented of the variations in the elemental composition of suspended matter and sediment in the St. Lawrence river and estuary. Water samples were taken during May and November of 1976 at periods of high and low river discharge, respectively. Suspended particulate matter was sampled 635 times. An abrupt change in elemental composition was noted when traversing the front at the landward edge of the turbidity maximum. There appeared to be no relationship between salinity and elemental composition. The data collected clearly demonstrate the importance of estuaries in influencing the geochemistry of particulate matter accumulating and passing through. Among the important processes are diagenetic mobilization within the fine-grained sediments, early settling of the coarse-grained components and further size sorting within the turbidity maximum, and depletion of certain elements from the sediment and their export out of the estuary. (Baker-FRC)
W81-02822

ESTUARINE FISH COMMUNITIES OF THE EASTERN JAMES-HUDSON BAY COAST,
Laval Univ., Quebec. Centre d'Etudes Nordiques.
R. Morin, J. Dodson, and G. Power.
Environmental Biology of Fishes, Vol 5, No 2, p 135-141, April, 1980. 1 Fig, 5 Tab, 31 Ref.

Descriptors: *Estuaries, *Fish populations, *Hudson Bay, *James Bay, Canada, Saline water fish, Brackish water fish, Marine fish, Cold water fish, Fish types, Fish taxonomy, Fish barriers, Aquatic habitats, Distribution patterns.

Fish distribution was studied in 6 estuaries along 900 km and 7 degrees latitude on the east coast of James and Hudson Bays between 1973 and 1977. A total of 15 families and 38 species were found, 35 species in the estuaries and rivers of James Bay, the more southern water, and 24 in those of Hudson Bay. Freshwater species were reduced toward the north, euryhaline species being favored. Marine species, arctic and subarctic, accounted for less than a third of inshore fish, and were rare in estuaries of the southernmost water studied. Freshwater species may be less plentiful in the north because of the more rigorous climate, failure to penetrate beyond certain watersheds in the postglacial dispersion, and the limited distances to the first fish barrier in northern rivers. (Cassar-FRC)
W81-02834

NITROGEN AND PHOSPHORUS DISTRIBUTION AND UTILIZATION BY SPARTINA ALTERNIFLORA IN A LOUISIANA GULF COAST MARSH,
Louisiana State Univ., Baton Rouge. Lab. for Wetland Soils and Sediments.
R. J. Buresh, R. D. DeLaune, and W. H. Patrick, Jr.
Estuaries, Vol 3, No 2, p 111-121, June, 1980. 6 Fig, 2 Tab, 33 Ref.

Descriptors: *Nitrogen cycle, *Phosphorus compounds, *Salt marshes, Spartina alterniflora, Plant growth, Nutrients, *Louisana, *Estuaries, Water pollution effects, Path of pollutants, Nitrogen compounds, Phosphorus, Ammonium compounds, Wetlands, Coastal marshes, Marshes, Biomass, Soil chemical properties.

Nitrogen and phosphorus contents of Spartina alterniflora and soil nitrogen were studied along a 23 meter transect perpendicular to a stream in a Louisiana salt marsh. In June and September total N and P in plants were greater near the stream than at inland sites. Soil N varied from 0.43% 1.5 meters from the stream to 0.86% at 23 meters inland. Sediment N was 0.55%. Extractable ammonia-N levels in the sediment were 22.5 micrograms per gram (dry soil weight basis); 40-45 micrograms per gram 20 meters from the stream in the presence of sparse vegetation; and 4-7 micrograms per gram at 1.5 to 17 meters from the stream. Addition of labeled ammonia-N at 200 kg per hectare to an inland site increased biomass by 25-28% after four months. The ratio of below-ground plant material to above-ground plant material decreased from 5.7 to 4.7. Added phosphate-P did not significantly change plant height or biomass. About half the N in the above-ground portion of the plants was derived from added ammonia-N. After four months, 28-29% of added labeled N was recovered in the plant tissue, indicating that Spartina may serve as a sink for N entering the wetlands. Soil N was 99% organic, 1% inorganic, and not readily available to the plants. Above-ground plant tissue accounted for only 2% of the total N in the system (plants and soil to a depth of 20 cm), root systems 14%, and soil 84%. (Cassar-FRC)
W81-02840

RATE OF OCCURRENCE OF FALSE-POSITIVE RESULTS FROM TOTAL COLIFORM MOST-PROBABLE-NUMBER ANALYSIS OF SHELLFISH AND ESTUARIES,
Maryland Univ., College Park. Dept. of Microbiology.
D. Hussong, R. R. Colwell, and R. M. Weiner.
Applied and Environmental Microbiology, Vol 40, No 5, p 981-983, November, 1980. 1 Fig, 3 Tab, 15 Ref.

Descriptors: *Estuaries, *Bacterial analysis, *Most probable number test, *Shellfish, *Coliforms, Errors, Temperature, Oysters, Analysis of variance, *Chesapeake Bay.

Chesapeake Bay oysters and oyster beds were examined over a 2-year period to determine the rate of false-positive results from total coliform most-probable-number analysis of shellfish and estuaries. The sampling sites selected were commercially important oyster harvest areas, and the water column of both areas was subject to very little fecal contamination. Salinity and temperature of the water were measured, and a homogenized solution of oysters was prepared. A five-tube, total coliform MPN analysis of water, sediment, and oyster samples indicated that false-positive results were related to water temperature. In the past, total coliform MPN results for cold estuarine water samples were subject to high error. It is recommended that total coliform MPN evaluations of estuarine water, shellfish, and sediment samples include the complete test whenever the water temperature falls below 15 deg C. (Small-FRC)
W81-02847

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

HIGH RECOVERY SEED SLURRY REVERSE OSMOSIS DEMONSTRATION FOR DESALTING WATERS SATURATED IN CALCIUM SULFATE.
Resources Conservation Co., Seattle, WA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-193989, Price codes: A03 in paper copy, A01 in microfiche. Final Report, Prepared for Office of Water Research and Technology, February, 1981. 40 p, 17 Fig. OWRT-C-00040-D(No 0451)(1), 14-34-0001-0451.

Descriptors: *Desalination, *Reverse osmosis, *Membrane processes, Tubular cellulose acetate membrane, Brackish water desalting, *Calcium sulfate removal, Roswell, New Mexico.

The purpose of this work was to demonstrate the technical feasibility of RCC's patented seeded slurry reverse osmosis process for desalting waters saturated in calcium sulfate. This was carried out by operating a portable seeded RO test unit at the OWRT test facility in Roswell, New Mexico. The field test was conducted in September and October of 1980. This unit was operated for a month at a recovery of 90% or more with no indication of scaling or fouling. It took a feed that was close to saturation with calcium sulfate and concentrated it by a factor of 10. The only pretreatment used was 25 micron filtration, acidification and chlorination. During the test the modules continuously saw a suspended solids level of 15,000 mg/l or more. This demonstrates a unique way of operating a reverse osmosis system and a process for achieving high recovery when operating on waters nearly saturated in slightly soluble salts, e.g., calcium sulfate and silica.
W81-02659

3C. Use Of Water Of Impaired Quality

EVALUATION OF THE IMPACT IMPOSED UPON SURFACE WATER SOURCES BY IMPLEMENTATION OF THE FEDERAL WATER CONSERVATION AND REUSE POLICY IN A RIVER BASIN WITH A WATER SURPLUS,
Eastern Tennessee State Univ., Johnson City. Dept. of Environmental Health.
C. S. Bishop, and R. R. Jacobs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-193930, Price codes: A04 in paper copy, A01 in microfiche. University of Tennessee, Knoxville, Tennessee Water Resources Research Center, Research Report No 84, October, 1980. 41 p, 11 Tab, 5 Ref, 1 Append. OWRT-A-061-TENN(1), 14-34-0001-0145.

Descriptors: Federal jurisdiction, Surface water availability, *Water law, *Water quality, *Water reuse, *Water supply, Evaluation, *Model studies, Prediction, Legal aspects, Water quality standards, Water quality management, Potential water supply, Water management, Projections, Forecasting, Estimating, Surface water, Water use, Water conservation, Policy making, River basins, Baseline studies, Tennessee, Washington County.

This study was designed to determine baseline data on water quality in the Washington County, Tennessee section of the French Broad River Basin, and then project the consequences of three water conservation and reuse scenarios on water quality in a water surplus area: (1) no significant water conservation and reuse; (2) 10% water use voluntary reduction; (3) 30% reduction through a governmental program of incentives and regulatory restrictions. Sampling sites were selected to assess effects of non-point and point source inputs on water quality. The Nolichucky River and its tributaries appeared of good water quality; the River was not being used excessively as an industrial/domestic water resource or as a receiving water system for Washington County waste effluents. If the current water level usage continues, the Nolichucky will be able to absorb the negative influences on water quality without water conservation. Also, neither a voluntary 10% reduction nor a mandatory 30% reduction in water use will significantly alter the River water quality. (Zielinski-IPA)
W81-02654

EVALUATION OF INDUSTRIAL COOLING SYSTEMS USING RECLAIMED MUNICIPAL WASTE WATER, APPLICATION FOR POTENTIAL USERS,

Montgomery (James M.), Inc., Pasadena, CA.
R. R. Trussell, G. P. Treweek, K. P. Fox, P. H. Kreft, and G. J. Coulter.
California State Water Resources Control Board, Office of Water Recycling, Sacramento, Report November, 1980. 205 p, 33 Fig, 44 Tab, 39 Ref, 6 Append.

Descriptors: *California, *Waste water reclamation, *Water reclamation, *Water reuse, *Industrial water use, Water cooling, Municipal waste water, Industrial plants, Water use, Industrial water, Waste water treatment, Evaluation, Economic aspects, Cost analysis, *Impaired water use.

Among water-short regions of the country, waste water reclamation and reuse has become an increasingly important resource for meeting additional water needs. Industrial cooling water constitutes the third largest water-use category after agricultural irrigation and process water for manufacturing industries. This report describes the technical feasibility of additional industrial use of reclaimed waste water for cooling systems typically in use in southern California. Water shortages are predicted for southern California in the mid-to-late 1980s. Within the Los Angeles and Orange County areas alone, it is estimated that 96,000 acre-feet per year of municipal waste water could be used for industrial cooling. There is a gap between potential and existing applications in part because of uncertainty about the mechanics and costs of reuse for individual facilities. Several processes are available for treating reclaimed water. Each produces waste material that must be handled. Selection of the appropriate method depends on pretreatment water quality and the availability of adequate waste disposal facilities. Technical, institutional and cost components of industrial water reuse are described. The report analyzes existing reuse facilities and suggests guidelines for industries to use in evaluating their own potential for water reuse. The total annual costs of supply, transport and reuse of 3 million gallons per day(MGD) of reclaimed water for industrial cooling is approximately $1 million. It is suggested that public financing, perhaps as part of local or regional projects, would be appropriate to help fund such projects. (Garrison-Omniplan)
W81-02802

WASTEWATER EFFLUENTS FROM A TANNERY: THEIR EFFECTS ON SOIL AND VEGETATION IN PAKISTAN,
University of the Punjab., Lahore (Pakistan). Dept. of Botany.
K. H. Sheikh, and M. Irshad.
Environmental Conservation, Vol 7, No 4, p 319-324, Winter, 1980. 2 Fig, 4 Tab, 10 Ref.

Descriptors: *Tannery wastes, Saline soils, *Agriculture, Irrigation, *Imparied water use, Soil properties, Land reclamation, Chlorides, Water pollution effects, Sodium, Salinity, Pollutants, Crops, Industrial wastes, Salts, *Wastewater disposal, Reclamation, Ultimate disposal, Disposal, Water quality, *Pakistan.

Highly saline, greenish-blue tannery waste water effluents, which averaged 106.59 milliequivalents per liter Na, 93.3 meq chloride, and 14,000 micromhos per cm electrical conductivity, were used to irrigate crops in fields adjacent to the Firdaus tannery at Muridke, Pakistan. Although rice and mustard seeds did not germinate in soil watered with the pure effluent, they showed 79-80% germination in 3:1 dilution (distilled water:waste water). Farmers generally supplement the small volume of waste water with tube well irrigation. The fields, which were wasteland before tannery operation began, had significantly greater moisture content, water-stable aggregates, water-holding and cation-exchange capacities, quantity of organic matter, and exchangeable Na than a plot of adjacent wasteland. The cropland also had lower electrical conductivity, pH, concentrations of Ca, Mg, soluble Na, chlorides and sulfates, sodium adsorption ratio, and exchangeable Na than the wasteland. Therefore, application of tannery effluent to a very highly saline and sodic wasteland soil improved soil characteristics so that agriculture was eventually possible. However, use on normal soil is likely to create salinity problems. (Cassar-FRC)
W81-02897

3F. Conservation In Agriculture

WASTE WATER SPRAY TRANSPORT IN LAND APPLICATION,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
N. J. Zimmerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170540, Price codes: A10 in paper copy, A01 in microfiche. Ph.D. Dissertation, 1980. 246 p, 23 Fig, 24 Tab, 92 Ref, 8 Append. OWRT-B-104-NC(3).

Descriptors: *Waste water irrigation, *Irrigation, *Spray irrigation, Water use, Aerosols, *Pathogenic bacteria, Microorganisms, Bacteria, *Waste water disposal, Waste water farming, Waste water outfall, Direct irrigation, Land disposal, Spraying, Sprays, Pollution load, Water pollution sources, Pollutants, Bioindicators, Pollutant identification, Fallout, Pathogens.

A small portion of wastewater sprayed in a land irrigation or disposal system will be aerosolized, making possible airborne transport of pathogenic microorganisms. Two spray solutions (one containing Escherichia coli coliform bacteria; the other, a fluorescent dye, uranine) were simultaneously sprayed in an open field to simulate the aerosolized portion of a full-scale irrigation spray. Ambient concentrations were determined up to 300 meters downwind; maximum downwind concentrations being estimated from dye field data for 65 experimental runs. These data plus meteorological data (e.g., solar radiation, relative humidity, temperature, wind speed/direction) were analyzed to develop an appropriate atmospheric dispersion model. Linear regression analysis of all daytime runs gave an empirical model that predicted concentrations for 84% of the data within a factor of two. A bacterial airborne viability model indicated that logarithm bacterial death rate correlated inversely with relative humidity and directly to solar radiation. Evaluation of the overall study indicated low levels of pathogens (about one per cubic meter, 30 meters downwind from spraying). Dose-response infectivity and disease studies are needed to further assess health hazard potential. (Zielinski-IPA)
W81-02722

USE OF CROP CANOPY-AIR TEMPERATURE DIFFERENCE FOR IRRIGATION SCHEDULING,
Minnesota Univ., Minneapolis.
K. M. Geiser, E. R. Allred, and D. C. Slack.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198426, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, March, 1981. University of Minnesota Agricultural Engineering Report Series. 49 p, 4 Fig, 5 Tab, 27 Ref, 5 Append. OWRT-A-037-MINN(2), 14-34-001-0125.

Descriptors: *Irrigation efficiency, Irrigation requirements, *Air temperature, *Crop production, *Corn, *Scheduling, *Multivariate analysis, Irrigation, Irrigation engineering, Irrigation practices, Irrigation programs, Irrigation water, Temperature effects, Temperature, Thermal stress, Water stress, Crop yield, Canopy, Prediction, Regression analysis, Thermometers.

The difference in temperature (DT) between the crop canopy and the air enables an infrared thermometer to be used as a scheduling tool. As water becomes limiting, the crop temperature increases due to the lack of water for cooling by transpiration. The study objectives included development of a model for DT to schedule irrigations, testing the DT model by using it for corn irrigation scheduling in central Minnesota, and evaluating the model by comparison to unirrigated corn (and corn using irrigation scheduling by electric resistance blocks and an evaportranspiration model). Analysis of data (net radiation, wind speed, relative humidity, wet/dry bulb temperatures, available soil moisture and DT) collected over two corn growing seasons, (1978 and 1979 summers) indicated that DT was primarily dependent on net radiation. Multiple linear regression analysis gave an equation expressing DT as a function of available soil water, relative humidity and net radiation, which was used to determine critical temperature differences for initiating corn irrigation during the 1980 growing season. The method compared favorably with other more common irrigation scheduling methods, and indicated reduced water use without significant crop yield reductions. (Zielinski-IPA)
W81-02724

IRRIGATION OF CROPS IN THE SOUTHEASTERN UNITED STATES, PRINCIPLES AND PRACTICE,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
R. R. Bruce, J. L. Chesness, T. C. Keisling, J. E. Pallas, Jr., and D. A. Smittle.
Agricultural Reviews and Manuals ARM-S-9, May 1980. 60 p, 26 Fig, 25 Tab, 59 Ref.

Descriptors: *Irrigation practices, *Soil-water-plant relationships, *Crop production, Plant growth, Farm management, Climates, Fertilizers, Water deficit, Drought, Irrigation requirements, Humid areas, Soil temperature, Soil properties, Drought resistance, Plant physiology, Southeast U.S.

Although the basic relationships of plant growth, soil, and water are applicable in any climate and geographic region, the application of basic principles to particular plant-soil-water systems presents unique problems. The practices associated with irrigated agriculture in arid regions are not appropriate in a humid region like the southeast, where excess water can be as frequent a problem as a water deficit. The primary region of application of this review has soils chiefly classified as Udalfs and Udults existing in the udic water regime and thermic temperature regime. The region has more than 40 inches of mean annual precipitation, with less than 5 inches of absolute water deficit, and a mean annual soil temperature at the 20 inch depth between 59 and 72 degrees F. Most aspects of crop management are discussed in the context of irrigation practice to achieve high yields in this climate and these soils. Variations in drought tolerance among crop species and among cultivars may determine the water regime required for acceptable crop performance. The sensitivity of many crops to drought varies greatly with physiological growth stage. For typical crop, soil, and climate situations, procedures are outlined for selecting irrigation equipment and for operating the equipment to provide the dependable soil-water control necessary for meeting a crop's water needs. In this region, the managing of mobile nutrients deserves particular attention. Since nutrients can easily be applied through the commonly used irrigation systems, crop requirements can be programmed and met simultaneously with water requirements. (Moore-SRC)
W81-02780

APPLICATION OF WIND ENERGY TO GREAT PLAINS IRRIGATION PUMPING,
Science and Education Administration, Manhattan, KS. North Central Region.
For primary bibliographic entry see Field 8C.
W81-02781

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

BAYES-MARKOV ANALYSIS FOR RAIN-CATCHMENT CISTERNS,
Hawaii Univ., Honolulu. Water Resources Research Center.
Y-S. Fok, R. H. L. Fong, J. Hung, E. T.

Murabayashi, and A. Lo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-193963, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No 133, March, 1980. 100 p, 26 Fig, 5 Tab. OWRT-A-073-HI(3), 14-34-0001-8013, 9013.

Descriptors: *Cisterns, *Rainfall, *Water demand, *Storage capacity, *Water management(Applied), *Dynamic programming, Water conservation, Droughts, *Hawaii, Water storage, *Bayes-Markov analysis, Rainfall probabilities, Risk analysis, Design methodology, Operational methodology, Pauoa Flats rain gage, Oahu.

In many parts of the world, public water-supply systems have shown signs of an inability to adequately service increasing demand. As a result, water shortages have occurred and moratoriums on new development areas have been imposed. And because of recurrent droughts and the rapid acceleration of urban development in recent years, the rain-catchment system and its cost effectiveness are now regaining the attention of researchers and planners as a 'new' and important alternative water supply. Rainfall, catchment area, storage capacity of the cistern, and water demand are the four main elements considered in the design, operation and management of a cistern system. Expected weekly rainfall is the main uncontrollable element of concern to the cistern owner; therefore, to meet this problem, expected weekly rainfall probabilities were first simulated by the Bayesian analysis. Then the sequential property contained in the 25-yr rainfall record was utilized to generate the likelihood probability function by using the lag 1 Markov sequential analysis. The Bayes-Markov analysis was subsequently applied to obtain the weekly rainfall probabilities. As a result of these analyses, the Bayes-Markov probabilistic approach for weekly rainfall simulation has shown its usefulness. Design and operational methodologies are also presented in the report.
W81-02657

EFFECTS OF THE PROPOSED PROSPERITY RESERVOIR ON GROUND WATER AND WATER QUALITY IN LOWER CENTER CREEK BASIN, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-02678

EFFECTS OF THE RATE OF RELEASES FROM SAM RAYBURN RESERVOIR ON THE AERATION CAPACITY OF THE ANGELINA RIVER, EASTERN TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
J. Rawson, R. L. Goss, and I. G. Rathbun.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A094 303, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-58, July, 1980. 23 p, 4 Fig, 5 Tab, 3 Ref.

Descriptors: *Reservoir releases, *Aeration, *Water quality, *Dissolved oxygen, *Texas, Streamflow, Flow rates, Reservoir operation, Data collections, Sites, *Sam Rayburn Reservoir, Angelina River, Time of travel.

A three-phase study was conducted during July and August 1979 to determine the effects of varying release rates through the power-outlet works at Sam Rayburn Reservoir, eastern Texas, on aeration capacity of a 14-mile reach of the Angelina River below Sam Rayburn Dam. The dominant factors that affected the aeration capacity during the study time were time of travel and the dissolved-oxygen deficit of the releases. Aeration was low throughout the study but increased in response to increases in the dissolved-oxygen deficit and the duration of time that the releases were exposed to the atmosphere (time of travel). The average concentration of dissolved oxygen sustained by release of 8,800 cubic feet per second decreased from 5.0 milligrams per liter at a site near the power outlet to 4.8 milligrams per liter at a site about 14 miles downstream; the time of travel averaged about 8 hours. The average concentration of dissolved oxygen in flow sustained by releases of 2,200 cubic feet per second increased from 5.2 to 5.5 milligrams per liter; the time of travel averaged about 20 hours. (USGS)
W81-02686

PROCEEDINGS OF THE WORKSHOP ON AQUATIC WEEDS: CONTROL AND ITS ENVIRONMENTAL CONSEQUENCES, ENVIRONMENTAL PROTECTION AGENCY, ENVIRONMENTAL RESEARCH LABORATORY, GULF BREEZE, FLORIDA, FEBRUARY 25-26, 1980.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-181190, Price codes: A02 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/9-81-010, Walsh, G. E., Ed., February 1981. 28 p, 1 Fig, 2 Tab, 15 Ref.

Descriptors: *Aquatic weed control, *Environmental effects, *Chemcontrol, *Biocontrol, *Mechanical control, Integrated control measures, Herbicides, Ecosystems, Insects, Fish, Pathogens, Controlled release pesticides, Costs.

Participants at the workshop reviewed the state-of-the-art of chemical, biological, mechanical, and integrated control of aquatic weeds, and discussed problems and how the EPA can assist in working toward their solutions. For each control method the method is reviewed by the group leader and followed by an outline of important points and recommendations by the participants. Chemical control is the dominant control method but information is needed in five areas: an inventory of weed problems; lack of basic data on aquatic weeds; maintenance level for aquatic weeds; effectiveness and safety of 2,4-D; and controlled-release formulations. Biological controls have shown some success. Research is needed in the areas of host specificity, cost, and potential for altering ecosystems when insects are the controlling organisms; lack of information on plant pathogens, cost of their production, and necessity of repeated treatments when plant pathogens are used; and the use of grass carp and hybrid carp when fish are the controlling organisms. The cost of harvesting and disposal of weeds after mechanical control is often prohibitive, but the method allows rapid removal of plants. Problem areas include: effects on dispersal of weeds; time of harvesting; concepts of aquatic plant control and aquatic plant management; disposal of harvested weeds; harvesting of weeds as a method of nutrient removal; and utilization of harvested weeds. Integrated control, using two or more of the above methods can achieve more precise vegetation management. Possible combinations include: herbicide treatment followed by stocking with fish, or pathogen application; mechanical harvesting followed by fish or pathogens; treatment with insects followed by pathogens; and mechanical or chemical control followed by competitive plants. (Brambley-SRC)
W81-02787

4B. Groundwater Management

EVALUATING METHODS FOR DETERMINING WATER USE IN THE HIGH PLAINS IN PARTS OF COLORADO, KANSAS, NEBRASKA, NEW MEXICO, OKLAHOMA, SOUTH DAKOTA, TEXAS, AND WYOMING; 1979,
Geological Survey, Denver, CO. Water Resources Div.
F. J. Heimes, and R. R. Luckey.
Geological Survey Water-Resources Investigations 80-111, 1980. 118 p, 9 Fig, 15 Tab, 6 Ref.

Descriptors: *Groundwater resources, *Water use, Water utilization, *Aquifer management, *Irrigation, Pumping, Discharge measurement, Instrumentation, Regional analysis, Analytical techniques, Mapping, Aerial photography, Remote sensing, Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, Wyoming, *High Plains aquifer.

The volume and areal distribution of ground-water withdrawals (pumpage) for irrigation during 1980 are required for the High Plains Regional Aquifer-System Analysis. In 1979, approaches and instrumentation that might be suitable for application to 1980 water-use determinations were tested. Pumpage was sampled by monitoring time of operation and discharge of irrigation wells during the growing season. The total volume pumped during the irrigation season was compared to the crop type and acreage irrigated. This comparison provided a means of extending sampled pumpage information to unmonitored areas using irrigated cropland maps. A transient-time flowmeter and a vibration-sensitive timing device proved to be reliable in providing discharge and time of operation information, respectively. Statistical analysis of comparisons between pumpage and irrigated cropland indicated that significant differences existed in the amounts of water applied between flood and sprinkler irrigation systems. However, statistical analyses of differences in amounts of water applied for different crop types and for selected climatic factors were inconclusive. A variety of approaches were tested to develop the irrigated cropland maps needed to extend sampled pumpage data. Of the methods tested, only Landsat data proved to be effective for application to an area as large as the High Plains. The results obtained in the 1979 evaluation of instrumentation and pumpage sampling approaches have been used to formulate a strategy for monitoring irrigation water use in the High Plains in 1980. (USGS)
W81-02691

EFFECTS OF ARTIFICIAL-RECHARGE EXPERIMENTS AT SHIP CREEK ALLUVIAL FAN ON WATER LEVELS AT SPRING ACRES SUBDIVISION, ANCHORAGE, ALASKA,
Geological Survey, Tacoma, WA. Water Resources Div.
W. Meyer, and L. Patrick.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $5.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1284, 1980. 42 p, 22 Fig, 2 Tab, 4 Ref.

Descriptors: *Artificial recharge, *Water levels, *Groundwater, *Model studies, *Land use, Aquifer characteristics, Groundwater movement, Observation wells, Water level fluctuations, Forecasting, Hydrogeology, Hydrographs, Alaska, *Anchorage.

The effect of the artificial recharge experiments on water levels at Spring Acres subdivision, Anchorage, Alaska, was evaluated using two digital models constructed to simulate groundwater movement and water-level rises induced by the artificial recharge. The models predicted that the artificial recharge would have caused water levels in the aquifer immediately underlying Spring Acres subdivision to rise 0.2 foot from May 20 to August 7, 1975. The models also predicted a total rise in groundwater levels of 1.1 feet at this location from July 16, 1973 to August 7, 1975, as a result of the artificial-recharge experiments. Water-level data collected from auger holes in March 1975 by a consulting firm for the contractor indicated a depth to water of 6-7 feet below land surface at Spring Acres subdivision at this time. Water levels measured in and near Spring Acres subdivision several years before and after the 1973-75 artificial-recharge experiments showed seasonal rises of 2 to 12.4 feet. A depth to water below land surface of 2.6 feet was measured 600 feet from the subdivision in 1971 and in the subdivision in 1977. Average measured depth to water in the area was 7.0 feet from early 1976 to September 1979. (USGS)
W81-02696

STUDY PLAN FOR THE REGIONAL AQUIFER-SYSTEM ANALYSIS OF ALLUVIAL BASINS IN SOUTH-CENTRAL ARIZONA AND ADJACENT STATES,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 6A.
W81-02701

ASSESSMENT OF PUBLIC GROUNDWATER SUPPLIES IN ILLINOIS,

Illinois State Water Survey, Urbana.
A. P. Visocky, H. A. Wehrmann, and K. W. Kim.
Circular 144, 1980. 74 p, 2 Fig, 1 Tab, 2 Ref, Append.

Descriptors: *Illinois, *Aquifer characteristics, *Groundwater management, Groundwater depletion, *Aquifer testing, Aquifer management, Aquifers, Well yield, Observation wells, Groundwater reservoirs, Groundwater storage, Bedrock, Glacial drift, *Groundwater availability.

This report summarizes available information regarding the current status of public groundwater supplies in Illinois, excluding the six northeastern counties. Data on each public groundwater supply were reviewed, and supplies were assessed as adequate, marginal, or deficient, in terms of present demands. The study indicated that thirty-nine supplies were marginal for current use and four were deficient. The majority of the marginal and deficient supplies are located in the central third of the state, where most of the other supplies are also located. The 677 public groundwater supplies outside northeastern Illinois have an estimated daily pumpage of 233 million gallons. Among the individual counties, Winnebago County had the highest daily pumpage, with 43.1 mgd. The largest individual supply is the city of Rockford, which pumps an average of 37 mgd. The largest supplies were generally obtained from major alluvial or bedrock valley deposits. Thirty counties were found to have one or more supplies that are less than adequate. This report is part of a three-part plan to study and test water resources and determine alternatives where necessary. (Garrison-Omniplan)
W81-02794

ADEQUACY AND ECONOMICS OF WATER SUPPLY IN NORTHEASTERN ILLINOIS: PROPOSED GROUNDWATER AND REGIONAL SURFACE WATER SYSTEMS, 1985-2010,
Illinois State Water Survey, Urbana.
K. P. Singh, and J. R. Adams.
Report, May 1980. 200 p, 47 Fig, 68 Tab, 39 Ref, Append.

Descriptors: *Illinois, *Groundwater resources, Well yield, *Economic aspects, *Groundwater availability, Costs, Municipal water, Economic yield, Well data, Cost analysis, *Water supply development, Cost-benefit ratio, River systems, Aquifer management, Radium radioisotopes, Groundwater management.

The purpose of this three-year cooperative effort between the State Water Survey and the Division of Water Resources was to plan for the optimal use of water resources in northeastern Illinois and to ensure that all towns in Cook, Du Page, Kane, Lake, McHenry, and Will Counties will have an adequate and dependable water supply up to the year 2010. This area has a population of about seven million and a land area of 3,714 square miles; municipal and industrial water supplies are presently obtained either from Lake Michigan or from groundwater. Future water demands were projected using the appropriate equation with a multiplier to account for each town's variation from the average regression equation. Cost functions, in terms of July 1980 dollars, were developed for wells, well pumps, reservoirs, water treatment, pipelines, and pipeline pumping stations. The optimal systems and their projected demands for 2010 were found to be: Lake County system supplying 17 towns, 27.80 mgd; Southern Cook County system supplying 8 towns, 19.98 mgd; Du Page County system supplying 19 towns, 77.55 mgd; Northwestern Cook County, 14 towns, 61.59 mgd; Fox River system, 8 towns, 35.61 mgd; and Kankakee River system, 10 towns, 25.33. Except for the Fox River system, conjunctive use is not economical. (Garrison-Omniplan)
W81-02795

4D. Watershed Protection

CONSERVATION TILLAGE: BEST MANAGEMENT PRACTICE FOR NONPOINT RUNOFF,
Wisconsin Univ.-Madison. Dept. of Soil Science.
D. H. Mueller, T. C. Daniel, and R. C. Wendt.
Environmental Management, Vol 5, No 1, p 33-53, January, 1981. 8 Fig, 8 Tab, 70 Ref.

Descriptors: *Soil conservation, *Erosion control, *Cultivation, Soil management, Contour farming, Erosion, Furrows, Soil erosion, Water pollution sources, Conservation tillage.

Conservation tillage, alone or in combination with other conservation practices, is an effective method for solving serious water erosion problems. It may also be useful in controlling wind erosion in dry areas. Conservation tillage is any tillage system that reduces the loss of soil and/or water when compared to unridged or clean tillage. Disking and no-till planting are two such systems. Conservation tillage practices can produce yields equal to or better than conventional techniques, and less phosphorus is lost from the land. No-till and contoured chisel plowing can reduce soil loss by approximately 90%, while other methods may reduce soil loss by 50%. Total phosphorus losses are reduced, but there have been no studies on the effects of this on aquatic life. There may be lower sediment phosphorus loss but higher available phosphorus loss. It is also unclear if pesticide losses are reduced. (Small-FRC)
W81-02818

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

SURVEY AND CONTROL OF SYNTHETIC ORGANICS IN TEXAS WATER SUPPLIES,
Texas A and M Univ., College Station. Water Resources Inst.
B. Batchelor, J. D. Shannon, and P-d. Yang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198384, Price codes: A08 in paper copy, A01 in microfiche. Technical Report 109, January, 1981. 155 p, 41 Fig, 5 Tab, 136 Ref, 3 Append. OWRT-A-047-TEX(1), 14-34-0001-9046, 14-34-0001-0146.

Descriptors: *Texas, *Water quality control, *Chlorinated hydrocarbons, Chlorination, *Water treatment, Coagulation, Turbidity, Synthesis, Lakes, Rivers, Chlorine, Halogens, Residual chlorine, Waste water treatment, Organic compounds, Water analysis, Trace levels, Toxins, Chemical treatment, Waste water oxidation, Oxidation process.

The primary objective was to evaluate the significance of synthetic compounds produced during treatment in selected water supplies and to study the effectiveness of conventional/nonconventional treatment technology for their control. Four Texas water supplies (Lakes Somerville and Livingston, and the Neches and Sabine Rivers) were surveyed to determine their tendency to form trihalomethanes (THM) when chlorinated. Conventional alum coagulation (CAC) was studied in a series of jar tests; effect of pH and alum dose was determined for removal of THM formation potential (THMFP), uv-absorbance, total organic carbon, and visible-absorbance. The latter was used as a surrogate for turbidity. Modification of CAC (addition of acid or base, or of secondary coagulants) was studied; a medium molecular weight cationic polymer and activated silica were used with alum and as sole coagulants. An innovative treatment process for removal of THMFP was also investigated. Batch and continuous flow systems using activated alumina adsorption significantly removed organics, uv-absorbance and THMFP from drinking water. (Zielinski-IPA)
W81-02719

DEVELOPMENT OF METHODS FOR THE DETECTION OF TRACE AMOUNTS OF SELECTED CARCINOGENIC AND MUTAGENIC AMINES IN WATER,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
J. C. Means, E. G. Perkins, D. Ellis, and M. M. Chaudry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198350, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, February, 1981. Illinois Water Resources Center, University of Illinois Research Report 156. 51 p, 16 Fig, 12 Tab, 49 Ref. OWRT-B-107-ILL(1), 14-34-0001-8081.

Descriptors: Technology, *Detection limits, *Trace levels, *Nitrogen compounds, *Water pollution, *Carcinogens, Chromatography, Technology transfer, Organic compounds, Organic loading, Gas chromatography, Gas liquid chromatography, Separation, Techniques, Sampling, Sample preparation, Water sampling, Water quality measurement, Stream pollution, Hazardous materials, Toxins.

Efforts were focused on the development of analytical schemes for reliable detection, separation, and quantification of trace levels of a number of aromatic and heterocyclic amines using both liquid (HPLC) and gas (GLC) chromatography. Field evaluations of the final methods were carried out and reported. It was found that GLC with flame-ionization and nitrogen-specific detection can successfully be used for analysis of amine mixtures of wide volatility using fairly non-polar columns (e.g., OV-17; Tenax GC). Some high-volatility amines appear lost during extraction/concentration; thus, XAD resin columns may be superior for amine concentration and also eliminate tedious extraction steps that affect amine recoveries. Use of river water as a matrix showed that some amines bind to biological and/or inorganic particulate matter present; procedures are needed to account for such bound residues. HPLC (UV/fluorescence detection) successfully analyzed the amine mixtures also, using acetonitrile gradients in water and reverse-phase C-18 columns. HPLC may offer some advantages in analyzing thermally-labile amines or polar metabolities of amines. (Zielinski-IPA)
W81-02721

GC/MS METHODOLOGY FOR MEASURING PRIORITY ORGANICS IN MUNICIPAL WASTE WATER TREATMENT,
Cincinnati, OH. Municipal Environmental Research Lab.
D. F. Bishop.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127813, Price codes: A02 in paper copy, A01 in microfiche. Project Summary EPA-600/S2-80-196, December, 1980. 5 p, 2 Fig, 1 Tab, 9 Ref.

Descriptors: *Mass spectrometry, *Gas chromatography, *Organic compounds, *Municipal waste water, Sludge, Pollutants, *Waste water analysis, Pollutant identification, Waste water treatment.

An EPA-developed methodology for measuring priority toxic organics in municipal waste waters and sludges is based on gas chromatography/mass spectrometry (GC/MS) technology. The methodology separates the purgeable priority organics from the sample by purging with inert gas and trapping the organics on a Tenax and silica gel trap. The organics are then desorbed, identified, and quantitated with packed column GC/MS analysis. The extractable organics are separated by extracting with methylene chloride, first at pH 11 and then at pH 2. The organics in the two extracts are identified and quantitated by packed column GC/MS analysis. The basic methodology analyzes the purgeable organics in municipal wastewaters satisfactorily but requires one modification in the equipment. By substituting charcoal for the silica gel in the trap, all of the purgeable priority organics are identified and satisfactorily quantified. In the basic methodology for extractable organics, a few of the organics are not measured well. Extracts may require clean-up or organic separation before GC/MS analysis. Principal classes of organic interferences include lipids, fatty acids, and saturated hydrocarbons. The approaches to separate the desirable priority organics from the interferences include acid-base separation, molecular size separation, and polarity separation. (Moore-SRC)

W81-02784

DETERMINATION OF LEAD IN DRINKING WATER BY ATOMIC ABSORPTION SPECTROPHOTOMETRY WITH ELECTROTHERMAL ATOMISATION,
Severn-Trent Water Authority, Nottingham (England). Regional Lab.
M. P. Bertenshaw, D. Gelsthorpe, and K. C. Wheatstone.
Analyst, Vol 106, No 1258, p 23-31, January, 1981. 1 Fig, 8 Tab, 15 Ref.

Descriptors: *Lead, Water analysis, Lanthanum, Spectrometry, Analytical techniques, *Pollutant identification, *Drinking water, *Atomic absorption spectrophotometry.

Determination of lead in water by electrothermal atomization was improved by pretreatment with lanthanum, either by addition of lanthanum chloride to the sample or preferably, by impregnation of the furnace tube. Samples pretreated with lanthanum chloride were given 0.1% mass/volume for manual injection and 0.01% mass/volume for automated injection. Impregnation of furnace tubes was done by immersing the tubes in a concentrated solution of lanthanum nitrate and leaving in a vacuum desiccator until the solution had been absorbed. Limit of detection was less than 1.0 microgram per liter, total standard deviation less than 1.5 micrograms per liter or 5% of the concentration, and bias less than 5 micrograms per liter or 10% of the concentration over a range of 0-100 micrograms per liter. (Cassar-FRC)
W81-02811

SCANNING ELECTRON MICROSCOPE EVIDENCE FOR BACTERIAL COLONIZATION OF A DRINKING-WATER DISTRIBUTION SYSTEM,
California Univ., Irvine. Div. of Environmental Analysis.
H. F. Ridgway, and B. H. Olson.
Applied and Environmental Microbiology, Vol 41, No 1, p 274-287, January, 1981. 14 Fig, 26 Ref.

Descriptors: *Iron bacteria, *Bacteria, *Distribution systems, Pipes, Water supply systems, Microorganisms, Corrosion, *Pollutant identification, Gallionella, Potable water.

The nature and characteristics of microorganisms on the surfaces of a water distribution main in service for 25 years and in particulate matter in fire hydrant water and well water were examined by scanning electron microscope. The bacteria-like structures and microcolonies, sparsely and randomly distributed along the pipe surfaces, included chain-forming cocci, filamentous types (most frequently observed), prosthecate types (usually found in oligotrophic environments), and Gallionella, an iron-oxidizing bacterium with typical spiral stalks. The surfaces of suspended particles contained large numbers of rod-shaped bacteria. Major elements detected by X-ray energy scans of the pipe surface were Si, P, S, Ca, and Fe. Minor amounts of Zn, Mg, Al, K, and Mn were slso seen. These microorganisms could be responsible for taste, odor, or color problems in water systems. In addition, the bacteria count may be underestimated. Extensive aggregation of cells and the building of slime layers may reduce the effectiveness of disinfection methods and encourage further pipe fouling and corrosion. (Cassar-FRC)
W81-02812

INCIDENCE OF PLASMIDS IN MARINE VIBRIO SPP. ISOLATED FROM AN OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO,
Houston Univ., TX.
H. S. Hada, and R. K. Sizemore.
Applied and Environmental Microbiology, Vol 41, No 1, p 199-202, January, 1981. 1 Fig, 2 Tab, 22 Ref.

Descriptors: *Plasmids, *Bacteria, *Marine bacteria, *Oil pollution, Aquatic bacteria, Water pollution effects, Bioindicators, Vibrio, Microbiology, *Gulf of Mexico.

Vibrio spp. were collected from an operating oil field 50 km south-southeast of Galveston, Texas, in the Gulf of Mexico and examined for the presence of plasmids, extrachromosomal deoxyribonucleic acid elements. The oil field Vibrio spp. samples had 35% plasmid-containing samples with an average of 2.5 (range 2-7) plasmids each; the control site, 23%, with an average of 1.5 plasmids each. Over half the plasmids were in the size range 0-12 Megadaltons, a substantial number were in the 10-80 Mdal range, very few greater than 80, and none over 100. Low level chronic pollution from hydrocarbons and sulfur is believed to be the cause of these changes. (Cassar-FRC)
W81-02813

THE STATISTICAL DISTRIBUTION OF SEWAGE AND SLUDGE ANALYSES,
Oxford Univ. (England), Dept. of Agricultural Science.
P. H. T. Beckett.
Environmental Pollution (Series B), Vol 1, No 1, p 27-35, January, 1980. 5 Fig, 1 Tab, 6 Ref.

Descriptors: *Sewage sludge, *Sludge disposal, *Statistical methods, Sampling, Analysis, Heavy metals, Metals, Copper, Nickel, Zinc, Cadmium, Lead, Chromium, Pollutant identification, Path of pollutants, Sewage, Agriculture, Soil amendments, Disposal, *Great Britain.

Heavy metals were determined in successive samples of raw sewage and digested sewage sludge from a medium-sized sewage works in Great Britain over the period August-December 1973. Cu, Ni, Zn, Cd, Pb, and Cr concentrations in finished sludge were log normally distributed about their central value. However, raw sewage analyses showed marked skewness to high values, with Cu, Zn, and Cd also showing minor low peaks. This variability may have been caused by dilution at the source or reduction in industrial production during holidays and weekends. Cu levels were highest on Tuesday through Thursday; Zn, Cd, Pb, and Cr, highest on Thursday; and Ni, highest on Thursday through Sunday. All metal levels were reduced by half or more during Christmas week. Rainfall had very little effect on metal concentrations. An understanding of these distributions is essential when sludge is applied on agricultural land. (Cassar-FRC)
W81-02817

MEASUREMENT OF PHYSIOLOGICAL CONDITION OF MUSSELS TRANSPLANTED ALONG A POLLUTION GRADIENT IN NARRAGANSETT BAY,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5C.
W81-02819

AN ION-EXCHANGE TECHNIQUE FOR CONCENTRATING AMMONIA FROM SMALL VOLUMES OF SEAWATER,
Oregon State Univ., Corvallis. Dept. of General Science.
R. T. Riley, and M. C. Mix.
Marine Chemistry, Vol 10, No 2, p 159-164, 1981. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Ammonia, *Analytical techniques, Nitrogen, *Ion exchange, *Seawater, Water quality control.

A very sensitive method is described for the determination of ammonia in seawater. The method is suitable where the size of the seawater sample is limited due to experimental design. The method involves an ion-exchange concentration technique using the phenol-hypochlorite reaction for assaying the ammonia concentration in the ion-exchange column eluate. It has been used for seawater samples of 5 and 10 ml and can be scaled down for use with 1.0 ml samples. The method is based in part on the batch ion-exchange procedure for plasma ammonia as previously described. As an example of the method a 10 ml seawater sample was analyzed with ammonia concentrations established at 10 to 150 microgram/1. (Baker-FRC)
W81-02823

ISOLATION OF DISSOLVED ORGANIC MATTER AND COPPER-ORGANIC COMPLEXES FROM ESTUARINE WATERS USING REVERSE-PHASE LIQUID CHROMATOGRAPHY,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
G. L. Mills, and J. G. Quinn.
Marine Chemistry, Vol 10, No 2, p 93-102, 1981. 1 Fig, 2 Tab, 21 Ref.

Descriptors: Sea water, *Chromatography, *Organic matter, *Copper, *Estuaries, *Narragansett Bay, Rhode Island, Analytical techniques.

Preliminary results on the use of reverse-phase liquid chromatography (RPLC) in the study of marine dissolved organic matter (DOM), with particular emphasis on copper-organic complexes in estuarine waters, are reported. Seawater samples were collected from various salinity mixing regimes ranging from the Providence River in the upper Narragansett Bay, Rhode Island to the lower bay. The procedure succeeded in isolating 10-30% of the organic matter and up to 50% of the total dissolved copper from various bay samples. Chromatograms were obtained using high performance liquid chromatography of the isolated organic matter. Qualitative differences were noted in the organic matter content between sampling stations. (Baker-FRC)
W81-02824

CHROMATOGRAPHIC ENRICHMENT OF ACIDIC COMPOUNDS FROM ORGANIC SOLVENTS USING ALKALI METAL SILICATES,
Columbia National Fisheries Research Lab., MO.
D. L. Stalling, J. D. Petty, and L. M. Smith.
Journal of Chromatographic Science, Vol 19, No 1, p 18-26, January, 1981. 7 Fig, 2 Tab, 25 Ref.

Descriptors: *Chromatography, *Acids, *Phenols, Silicates, Alkali metals, Pollutant identification, Analytical techniques, Adsorption, Silica, Cesium, Potassium, Sodium, Lithium, Organic compounds, Pesticide residues, Herbicides.

Alkali metal (Li, Na, K, and Cs) hydroxide-treated silica gels were evaluated for their ability to retain, separate, and enrich trace residues of acidic components, especially substituted phenols. The method is applicable to determination of residues (including 2,4-D, picloram, and sulfa drugs) in tissues, soil, and water. Retention of acid compounds increased with increasing ionic radius of the alkali metal. Cs silicate was clearly superior for retention of sterically-hindered phenols such as 2,4,6-trimethylphenol, but BHT, 2,6-ditertiarybutyl-4-methyl phenol, did not react with any silica gel tried. Samples were applied to columns 1.0 x 8.5 cm in methylene chloride/cyclohexane 1:1 by volume and eluted with this solvent or 0 to 50% methanol mixed with this solvent. (Cassar-FRC)
W81-02829

INCIDENCE OF MARINE BDELLOVIBRIOS LYTIC AGAINST VIBRIO PARAHAEMOLYTICUS IN CHESAPEAKE BAY,
Maryland Univ., Baltimore. Dept. of Microbiology.
H. N. Williams, W. A. Falkler, Jr., and D. E. Shay.
Applied and Enviromental Microbiology, Vol 40, No 5, p 970-972, November, 1980. 2 Tab, 8 Ref.

Descriptors: *Estuaries, *Marine bacteria, *Bacterial analysis, Water sampling, Water properties, Water quality data, *Chesapeake Bay.

A study of the distribution of bdellovibrios lytic against Vibrio parahaemolyticus was undertaken in the Chesapeake Bay by collecting water samples at nine sites. The environmental parameters of each sample were determined. Examination of randomly selected plaques by phase and electron microscopy demonstrated the presence of curved, rod-shaped bacteria measuring approximately 0.3 microns in width and 10 microns in length. The characteristics and morphological properties observed indicated that the organisms were probably bdellovibrio plaque-forming units. There were no apparent relationships between the number of bdellovibrios iso-

lated from the sampling stations and the measured environmental parameters or the total number of bacteria recovered. Bdellovibrios were isolated from 8 of the sampling stations. Higher numbers than previously reported with sea or ocean water were recovered in the midregion of the bay. (Small-FRC)
W81-02845

ENUMERATION AND CHARACTERIZATION OF STANDARD PLATE COUNT BACTERIA IN CHLORINATED AND RAW WATER SUPPLIES,
Oregon State Univ., Corvallis. Dept. of Microbiology.
M. W. LeChevallier, R. J. Seidler, and T. M. Evans.
Applied and Environmental Microbiology, Vol 40, No 5, p 922-930, November, 1980. 2 Fig, 4 Tab, 27 Ref.

Descriptors: *Bacterial analysis, *Separation techniques, *Drinking water, *Raw water, Water quality data, Chlorination, Water supply, Actinomyces, Aerobacter, Enterobacter.

A simple scheme to rapidly identify standard plate count (SPC) bacteria is proposed, and the incidence and distribution of these organisms in chlorinated drinking water and raw surface water supplies of an Oregon coastal community were determined. Samples were collected from the drinking water supply of a community of 14,000 residents and from two streams supplying raw water to the city. Nearly 700 SPC bacteria were isolated from the two types of water and identified as to genus, species, or group. In the chlorinated water, Actinomycetes and Aeromonas species were the two most common groups. In the raw water, Aeromonas spp. and Enterobacter agglomerans were the two most common groups. Identification of bacterial populations before and after contact with chlorine at doses of 1 to 2 mg/liter for 1 hr revealed that chlorination selects for gram-positive bacteria. The membrane filter technique for enumerating SPC bacteria was found to recover significantly higher numbers than the standard pour plate technique. Thus, this is a useful method for determining water quality deterioration within a distribution system. (Small-FRC)
W81-02848

DETECTION OF LIPID DEGRADATION PRODUCTS IN THE WATER OF A RESERVOIR DURING A BLOOM OF SYNURA UVELLA,
Tuebingen Univ. (Germany, F.R.). Inst. fuer Chemische Pflanzenphysiologie.
F. Juttner.
Applied and Environmental Microbiology, Vol 41, No 1, p 100-106, January, 1981. 4 Fig, 4 Tab, 28 Ref.

Descriptors: *Organic compounds, *Algae, *Lipids, *Odor, Synura uvella, Eutrophication, Biodegradation, Aquatic algae, Pollutant identification, Analytical techniques, Water analysis, *Reservoirs, Odor-producing algae.

The offensive cod liver oil-like odor present in a reservoir during a Synura uvella bloom was attributed to trans,cis-deca-2,4-dienal and trans,cis-hepta-2,4-dienal. These substances and 53 more organic compounds were identified by stripping the volatile compounds from the raw water and detecting by gas-liquid chromatography. Air pollution was considered the source of some aromatic compounds and halogenated compounds. The alkenes (8 carbon), aldehydes (5-10 carbon), alcohols (5-8 carbon), ketones (5-11 carbon), and nor-carotenoids were regarded as algal excretion products. Although the cod liver odor masked all other odors, there were other odor-producing compounds present: beta-ionone (violets), beta-cyclocitral (tobacco), and oct-1-en-3-ol and 2-pentyl furan (both decaying fungi). (Cassar-FRC)
W81-02850

UTILIZATION OF LOW CONCENTRATIONS OF STARCH BY A FLAVOBACTERIUM SPECIES ISOLATED FROM TAP WATER,
Keuringsinstituut voor Waterleidingartikelen, Rijswijk (Netherlands).
D. van der Kooij, and W. A. M. Hijnen.
Applied and Environmental Microbiology, Vol 41, No 1, p 216-221, January, 1981. 5 Fig, 4 Tab, 29 Ref.

Descriptors: *Organic compounds, *Bacteria, *Starch, Carbohydrates, Flavobacteria, *Potable water, Pollutant identification, Water analysis, Analytical techniques, Microorganisms, Netherlands.

A yellow-pigmented bacterium of the Flavobacterium species was identified in tap water from the municipal Dune Waterworks, The Hague, The Netherlands. Here, dune-infiltrated river water is treated with powdered activated carbon, rapid sand filtration, and slow sand filtration. Dissolved organic carbon levels in the finished water were 2-3 mg C per liter. Although the bacteria were able to multiply in the plain tap water, addition of small amounts of starch and glucose (as low as 1 microgram carbon per liter) enhanced growth. Substrate affinities of the Flavobacterium were 3.9 micrograms of starch C and 3.3 micrograms of glucose C per liter. (Cassar-FRC)
W81-02851

RECOVERY OF COLIPHAGES FROM WASTE WATER EFFLUENTS AND POLLUTED LAKE WATER BY THE MAGNETITE-ORGANIC FLOCCULATION METHOD,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
G. Bitton, L. T. Chang, S. R. Farrah, and K. Clifford.
Applied and Environmental Microbiology, Vol 41, No 1, p 93-96, January, 1981. 4 Tab, 16 Ref.

Descriptors: *Flocculation, *Coliphages, *Water analysis, Microorganisms, *Bacteriophage, Effluents, Pollutant identification, Analytical techniques, Waste water.

A flocculation method using magnetite and isoelectric casein was used to recover coliphages from waste water effluent and sewage-contaminated lake water. It is rapid (30 min flocculation time), inexpensive, efficient, and suitable for field use. The method does not require centrifugation or filtration, only a large beaker and a U-shaped permanent magnet. Using the technique, 68, 90, and 100% of coliphages were recovered from activated sludge, trickling filter and primary effluents, respectively, working more effectively with the more concentrated effluents. Recovery of coliphages from a lake showed 230 to 1900 plaque forming units per liter. (Cassar-FRC)
W81-02852

SIMPLE METHOD FOR CONCENTRATION OF BACTERIA FROM LARGE VOLUMES OF TAP WATER,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
S. M. Goyal, and C. P. Gerba.
Applied and Environmental Microbiology, Vol 40, No 5, p 912-916, November, 1980. 5 Tab, 15 Ref.

Descriptors: *Filters, *Bacteria, *Separation techniques, *Drinking water, Escherichia coli, Salmonella, Microorganisms.

The use of positively charged depth filters for the concentration and detection of bacteria in large volumes of tap water was investigated. Dechlorinated tap water was passed under positive pressure through positively charged filter media. At ambient pH levels, more than 90% of seeded bacteria adsorbed to the filters. Adsorbed bacteria were eluted by passing a small volume of Trypticase soy broth opposite to the inflow. Using this technique, E. coli and Salmonella serovar B organisms in 20 liters of tap water were concentrated in a final volume of 50 ml. The average recovery efficiency was 30% or greater. The filters used consisted of a cellulose diatomaceous earth-charge-modified resin such as series S, Zeta-plus, (AMF CUNO, Meriden, Conn.) and eliminated the need for extensive acidification of the initial sample. The method could be useful when the concentration of bacteria is extremely low or could be used in conjunction with other methods for the rapid determination of microorganisms in water. (Small-FRC)
W81-02853

ORGANOCHLORINE COMPOUNDS IN MUSSELS FROM SCOTTISH COASTAL WATERS,
Freshwater Fisheries Lab., Pitlochry (Scotland).
A. A. Cowan.
Environmental Pollution (Series B), Vol 2, No 2, p 129-143, 1981. 4 Fig, 10 Tab, 24 Ref.

Descriptors: *Mussels, *Bioindicators, *Pesticide residues, Dieldrin, DDT, Water quality, Organic pesticides, Sea water, Chlorides, Water quality, *Scotland, *Coastal waters.

Mytilus edulis was used as a bioindicator to study the extent of pollution of Scottish coastal waters by pesticides and PCBs. Homogenates of total shell contents were made of between 29 and 50 animals, and organochlorine residue analysis was carried out. Concentrations of dieldrin, PCB, hexachlorocyclohexane, hexachlorobenzene, and total DDT were determined. The concentrations found ranged from one to three orders of magnitude. Mussels were found to be useful organisms for identifying areas significantly contaminated by organochlorines. The influence of the size, sexual maturity, and flushing procedure on the pesticide content in the mussel has not been fully determined, but changes are thought to be smaller than those found between polluted and clean areas. In this study, four sites were polluted by all three components, seven by two, and ten sites by one pollutant. (Small-FRC)
W81-02858

DETERMINATION OF MAGANESE IN NAIAD MOLLUSC SHELLS BY NEUTRON ACTIVATION ANALYSIS,
Ohio State Univ., Columbus.
R. T. Pruiskma, T. R. Sweet, D. H. Stansbery, and B. K. Hajek.
Environmental Pollution (Series B), Vol 2, No 1, p 49-57, January, 1981. 5 Fig, 1 Tab, 7 Ref.

Descriptors: *Bioindicators, *Mollusks, *Naiads, *Manganese, Rivers, Shellfish, Aquatic animals, Pollutant identification, Analytical techniques, Absorption, Water pollution effects, Path of pollutants, Muskingum River, *Ohio.

Shells from naiads in the Muskingum River, Ohio, were analyzed for manganese content by neutron activation analysis to determine their possible use as bioindicators of water pollution. Two species were obtained at Beverly, O., and 5 species 11 miles downstream at Lowell, O. The shells were part of a university museum collection. Mn concentrations at Beverly were as follows (in ppm): Obliquaria reflexa, 529 (1965), 1008 (1966), 646 (1967); Quadrula pustulosa, 509 (1965), 694 (1966), 591 (1967), and 408 (1968). At Lowell concentrations were Quadrula quadrula, 412-304 (1967-68); Amblema plicata, 366 (1967), 479 (1968); Obovaria subrotunda, 396 (1967), 354 (1968); Obliquaria reflexa, 862 (1965), 750 (1966); and Quadrula pustulosa, 276 (1965), 320 (1966), 328 (1967), and 403 (2068). Differences in manganese concentrations depending on species and year were observed in some cases. A significant (2% level) difference was found in Q. pustulosa manganese levels at the two locations studied, possibly due to differences in manganese content of the water as a result of coal mine drainage. (Cassar-FRC)
W81-02859

AFFINITY TESTS FOR THE DETECTION OF COMMUNITY ALTERATION IN PLANKTON: EVALUATION WITH A DISTRIBUTIONAL COMPUTER MODEL,
Georgia Univ., Athens. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W81-02860

DETECTION OF DIMETHYLNITROSAMINE AND DIETHYLNITROSAMINE IN MUNICI-

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

PAL SEWAGE SLUDGE APPLIED TO AGRICULTURAL SOILS,
Wright State Univ., Dayton, OH. Dept. of Biological Sciences.
W. S. Brewer, A. C. Draper, III, and S. S. Wey.
Environmental Pollution (Series B), Vol 1, No 1, p 37-43, January, 1980. 1 Fig, 1 Tab, 21 Ref.

Descriptors: *Sludge disposal, *Organic compounds, *Nitrogen compounds, Nitrosamines, Agriculture, Soil amendments, Sewage sludge, Water pollution sources, *Pollutant identification, Path of pollutants, DMN, DEN.

Sludges applied to agricultural soils contained a mean dimethyl nitrosamine content of 0.272 micrograms per gram (wet basis). Between 59.8-1365 micrograms nitrosamine may be incorporated into 1 cubic meter of soil at a mean application rate of 1.95 kg per sq meter per year. Nitrosamines, known to be carcinogenic, mutagenic, and teratogenic, and believed persistent in soils, could accumulate in groundwater, surface water, and plant material if applied as a soil amendment to agricultural land. Three analytical methods were used to analyze 16 samples of municipal waste water sludge--gas-liquid chromatography, thin-layer chromatography, and colorimetry. The colorimetric method detected nitrosamines in 11 samples. Using both chromatographic methods, either dimethyl nitrosamine, diethyl nitrosamine, or both were detected in a total of 8 samples. (Cassar-FRC)
W81-02866

ISOLATION AND IDENTIFICATION OF AN AMES-MUTAGENIC COMPOUND PRESENT IN KRAFT CHLORINATION EFFLUENTS,
Pulp and Paper Research Inst. of Canada, Pointe Claire (Quebec).
B. R. Holmbom, R. H. Voss, R. D. Mortimer, and A. Wong.
Tappi, Vol 64, No 3, p 172-174, March, 1981. 2 Fig, 8 Ref.

Descriptors: *Pulp wastes, *Chlorination, *Effluents, Organic compounds, Mutagenesis, Pollutant identification, Bacteria, Industrial wastes, Wastes.

An Ames-mutagenic compound in kraft chlorination effluents was tentatively identified as 3-chloro-4-dichloromethyl-5-hydroxy-2(5H)-furanone on the basis of high resolution mass spectroscopy and ultraviolet and infrared spectroscopic data. Concentration of this compound is 5-10 micrograms per liter in the original effluent. It has an Ames mutagenicity of 10,000 revertant counts per nanomole using TA100 with no S-9 addition as a test strain. The original effluent had an Ames mutagenicity of 2,000-3,000 revertants per ml effluent. (Cassar-FRC)
W81-02875

YEASTS FROM MARINE AND ESTUARINE WATERS WITH DIFFERENT LEVELS OF POLLUTION IN THE STATE OF RIO DE JANEIRO, BRAZIL,
Universidade Federal do Rio de Janeiro (Brazil). Dept. de Microbiologia Geral.
A. N. Hagler, and L. C. Mendonca-Hagler.
Applied and Environmental Microbiology, Vol 41, No 1, p 173-178, January, 1981. 1 Fig, 3 Tab, 29 Ref.

Descriptors: *Yeasts, *Coliforms, *Rio de Janeiro, Brazil, Microorganisms, *Estuaries, *Pollutant identification, Water pollution, Bacteria, Sewage bacteria, Bioindicators.

Yeasts were determined in water samples from 24 sites in the area of Rio de Janeiro, Brazil. Pollution levels and mean total coliform counts were as follows: heavy, 340,000 CFU per 100 ml; moderate, 9,600; light, 230; and nil, 73. Mean salinities varied from 14.2 to 27.4% in the estuarine sites. Mean total yeast counts for these 4 classifications of water were 2800, 200, 9.9, and 0.58 CFU per 100 ml. The most prevalent were Candida, Rhodotorula, Torulopsis, Hanseniaspora, Debaryomyces, and Trichosporon. Twenty-one species represented 86% of the total yeast counts. Although pink yeasts have been suggested as bioindicators for pollution, this study shows that they do not represent a consistent proportion of the yeast population and are not correlated with other specific pollution factors. (Cassar-FRC)
W81-02885

COMPARISON OF THE DIFFERENT METHODS FOR THE RECOVERY OF SUSPENDED MATTER FROM ESTUARINE WATERS: DEPOSITION, FILTRATION AND CENTRIFUGATION: CONSEQUENCES FOR THE DETERMINATION OF SOME HEAVY METALS,
Institut de Geologie du Bassin D'Aquitaine, Talence (France).
H. Etcheber, and J. M. Jouanneau.
Estuarine and Coastal Marine Science, Vol 11, No 6, p 701-707, December, 1980. 4 Tab, 12 Ref.

Descriptors: *Estuaries, *Heavy metals, *Separation techniques, Deposition, Filtration, Centrifugation, *Suspended solids, Metals, Analytical techniques, Water analysis, Gironde estuary, *France, Pollutant identification, Zinc, Copper, Manganese, Iron, Nickel, Lead, Turbidity.

Methods for recovery of suspended matter to determine heavy metal concentrations were compared in samples obtained from the Gironde estuary. Filtration produced the best recovery. Deposition was most useful in cases of flocculation and high turbidity. Centrifugation was satisfactory in zones of low turbidity. On low turbidity waters differences in the three methods were not significant for Fe, Mn, and Zn. However, deposition lost 20% of the Cu, 14% of the Pb, and 10% of the Ni when compared with filtration. Centrifugation caused increases in Ni (40%), Pb (12%), and Cu (uneven), possibly from equipment contamination. Analyses of high turbidity waters produced similar results with all 3 methods, but slight contamination of the Ni determinations occurred with centrifugation. (Cassar-FRC)
W81-02888

SIMULTANEOUS MEASUREMENTS OF TRANSPARENCY AND IRRADIANCE IN THE COASTAL WATERS OF NORTH WALES,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
B. J. Topliss, J. R. Hunter, and J. H. Simpson.
Marine Environmental Research, Vol 4, No 1, p 65-79, 1980-81. 4 Fig, 2 Tab, 19 Ref.

Descriptors: *Suspended solids, *Sea water, *Optical properties, Turbidity, Light penetration, Attenuation, Physical properties, Water properties, Pollutant identification, Coastal waters, *Wales, Great Britain.

Natural optical conditions of marine waters must be known before comparisons are made with measurements in polluted waters. Therefore, simultaneous measurements of the diffuse attenuation coefficient and the collimated beam attenuation coefficient were made continuously over a year off the coast of North Wales. The ratio of the collimated beam coefficient to the diffuse attenuation coefficient varied throughout the year between 11:1 and 5:1. Both parameters must be measured together to acquire an understanding of the nature of suspended material in the waters. (Cassar-FRC)
W81-02892

HEAVY METALS IN DONAX TRUNCULUS L. (BIVALVIA) IN HAIFA BAY, MEDITERRANEAN (ISRAEL),
Israel Oceanographic and Limnological Research Ltd., Haifa.
H. Hornung, and O. H. Oren.
Marine Environmental Research, Vol 4, No 3, p 195-201, 1980-81. 2 Fig, 3 Tab, 23 Ref.

Descriptors: *Bioindicators, *Mollusks, *Heavy metals, Baseline studies, *Pollutant identification, Analytical techniques, Metals, *Israel, Mediterranean Sea, Haifa Bay, Mercury, Copper, Zinc, Cadmium, Lead, Aquatic animals, Shellfish.

Since the common bioindicator Mytilus is absent from the Israeli Mediterranean shore, Donax (Serrula) trunculus, a mollusk common to this area, was chosen for a baseline study of heavy metal pollution. Mussels were collected in Haifa Bay during November 1975 - September 1978. Concentrations of metals in soft parts of the mussels, expressed in micrograms per gram (dry weight) were as follows: Hg, 0.04-0.91; Cu, 6.13-35.37; Zn, 51.2-141.6; Cs, 0.19-0.66; and Pb, 1.56-13.07. An inverse correlation between shell length and metal concentration was found for all metals but Pb. The author suggests that Donax trunculus should not be defined as an indicator of heavy metal pollution without a sampling program which includes the entire Israel coast. (Cassar-FRC)
W81-02894

5B. Sources Of Pollution

SEDIMENT AND ORGANIC MATTER TRANSPORT IN OREGON COAST RANGE STREAMS,
Oregon State Univ., Corvallis. School of Forestry.
R. L. Beschta, S. J. O'Leary, R. E. Edwards, and K. D. Knoop.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-193914, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Oregon State University Report WRRI-70, February, 1981. 67 p, 20 Fig, 4 Tab, 49 Ref. OWRT-A-042-ORE(1), 14-34-0001-7078.

Descriptors: *Pollution load, *Sediment transport, *Organic matter, Streamflow, *Oregon, *Coastal streams, Mathematical equations, Environmental protection, Nonpoint pollution sources, Population exposure, Tractive forces, Sediment grading, Sediment concentration, Sediments, Aquatic soils, Water quality, Organic loading, Flow, Streamflow forecasting, Coastal waters, Rating flumes, Suspended solids, Turbidity, Particulate matter.

The overall objective of this study was to provide an improved understanding of sediment and organic matter movement in mountain streams, utilizing monitoring of two streams, Flynn Creek and Oak Creek, located in Central Oregon's Coast Range, for bedload transport, particulate organic matter transport, total suspended solids (TSS) concentration, and turbidity. Winter precipitation was relatively low during the 1976-1980 water years studied; frequency analysis indicated peak flows had recurrence intervals of less than two years. Rating curves were developed through the relationship that particulate transport equalled a constant times streamflow (Q) to some power. Exponential increases of 3.4-4.5 in bedload transport rates with increasing flows were measured using vortex tube and Helley-Smith bedload samplers. Sediment particle diameter averaged less than 0.5 and 2 mm for Flynn and Oak Creeks, respectively. Rating curves of TSS with Q varied highly, but exponential TSS increases with increasing Q were generally 1.1-1.6 when flow ranges were sampled. Hydrograph characteristics, Q, and the storm events sequence influenced TSS, which averaged about 60% inorganics and 40% organics. TSS correlated highly with turbidity, and both returned to relatively low levels within 24 hours after peak flow occurrences. (Zielinski-IPA)
W81-02652

MECHANISMS OF TRANSPORT OF COPPER, CADMIUM AND CHROMIUM IN SOILS,
California Univ., Davis. California Water Resources Center.
J. W. Biggar, K. K. Tanji, D. R. Nielsen, and R. J. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-193922, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, March, 1981. 81 p, 59 Fig, 10 Tab, 26 Ref. (California Water Research Project UCAL-WRC-W-511). OWRT-B-180-CAL(2).

Descriptors: *Pollution load, Soil analysis, Soil chemistry, *Soil contamination, *Heavy metals, *Path of pollutants, Soil dynamics, Soil environment, Soil adsorption capacity, Soil profiles, Soil

properties, Soil science, Soil tests, Soil types, Fate of pollutants, Trace metals, Copper, Cadmium, Chromium, Model studies.

Copper (Cu) in the saturation extract of dried Davis, California, sewage sludge was mainly in complexed form; the extent of complexation determined with a cupric specific ion electrode. Adsorption experiments showed a distribution coefficient (Kd) of 4.0 for complexed Cu on Yoho soil, while Cu added as cupric sulfate had a Kd of 90 cubic-centimeters/gram. The low Kd values on soil and the large percentage of complexed Cu suggested that sewage sludge may be a potential source of contamination of water and plant systems. A general model for trace metal adsorption was studied; an equation for multi-speciated metal adsorption was developed, accounting for both exchange and chemical adsorption. The model was compared with experimental data. Transport of cadium (Cd) in Hanford sandy loam and Yoho silt loam soil was studied using soil columns, adsorption/desorption curves, breakthrough curves (BTC) and the significant effects of EDTA and pH on position/shape of the BTC. A suitable model is lacking to describe the position/shapes of the BTC, but a model to describe batch reaction results was partially successful. (Zielinski-IPA)
W81-02653

THE DISTRIBUTION, TRANSPORT AND CYCLING OF DISSOLVED AND PARTICULATE ORGANIC CARBON IN THE POTOMAC AND ANACOSTIA RIVERS IN THE GREATER WASHINGTON AREA,
American Univ., Washington, DC. Dept. of Biology.
M. A. Champ.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-193955, Price codes: A06 in paper copy, A01 in microfiche. D.C. Water Resources Research Center, University of the District of Columbia, Washington, Report No 13, November, 1979. 103 p, 23 Fig, 26 Tab, 34 Ref, 1 Append. OWRT-A-002-DC(1), 14-31-001-50502.

Descriptors: *Dissolved solids, *Urban runoff, *Particulate matter, *Organic carbon, Organic loading, Sediment transport, Cycling nutrients, Organic matter, Chemical analysis, Biological oxygen demand, Chemical oxygen demand, Pollution load, Streamflow, Water quality, Rivers, Suspended solids, River basins, River beds, Water analysis, Runoff, River flow, Surface runoff, Combined sewers, Effluent streams, *District of Columbia, Potomac River estuary, Anacostia River.

This project was undertaken to study the distribution, transport, seasonal cycling, and sources of dissolved organic carbon (DOC) and particulate organic carbon (POC) in the two subject District of Columbia area rivers, since rivers of high organic concentrations can have high BOD and COD values that lower oxygen concentrations to levels that can cause high mortality in aquatic life. DOC and POC concentrations were measured weekly for 17 main channel stations of the Upper Potomac River Estuary, and the distribution, production, transport and cycling of organic carbon was followed over a 12-month period. Special studies were conducted to evaluate the influence of tidal activity, flood storm crests and lateral variation on River DOC and POC levels. Mean DOC and POC levels reflected a seasonal and river mile sigmoid curve. DOC and POC transported annually by the Potomac to its Estuary were estimated at 54,000 and 37,000 metric tons, respectively. River DOC did not correlate with discharge, which POC does. DOC and POC levels in street runoff, storm and combined sewer overflows were 4-10 times higher than in Potomac River water. (Zielinski-IPA)
W81-02656

EFFECTS OF THE PROPOSED PROSPERITY RESERVOIR ON GROUND WATER AND WATER QUALITY IN LOWER CENTER CREEK BASIN, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
W. R. Berkas, and J. H. Barks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-152621, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-88, November 1980. 29 p, 6 Fig, 9 Tab, 8 Ref.

Descriptors: *Reservoir sites, *Groundwater, *Water quality, *Surface-groundwater relationships, *Baseline studies, *Missouri, Karst, Base flow, Groundwater movement, Groundwater recharge, Water levels, Seepage, Tracers, Tracking techniques, Mine water, Zinc, Fertilizers, Nitrates, Nutrients, Center Creek basin(MO), *Prosperity Reservoir(MO).

Effects of the proposed Prosperity Reservoir on groundwater and water quality in lower Center Creek basin, Mo., depend partly on the effectiveness of Grove Creek as a hydrologic boundary between the reservoir site and the Oronogo-Duenweg mining belt. Results of two dye traces indicate that Grove Creek probably is not an effective boundary. Therefore, higher water levels near the reservoir could cause more groundwater to move into the mining belt and cause a greater discharge of zinc-laden mine water into Center Creek. Fertilizer industry wastes discharged into Grove Creek resulted in significant increases of nitrogen and phosphorus in lower Center Creek. Results of seepage runs confirm that mine-water discharge and seepage account for the increased zinc concentrations in Center Creek during base flow. The nutrient and zinc concentrations in Center Creek, after the completion of the proposed reservoir, would depend upon the release schedule. (USGS)
W81-02678

CHEMICAL AND PHYSICAL CHARACTERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1974-SEPTEMBER 1975,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 2L.
W81-02684

A WATER-QUALITY MONITORING NETWORK FOR VALLECITOS VALLEY, ALAMEDA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
C. D. Farrar.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-157034, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-59, October 1980. 22 p, 5 Fig, 2 Tab, 12 Ref.

Descriptors: *Water quality, *Monitoring, *California, *Radioactive wastes, *Radioisotopes, Path of pollutants, Water pollution sources, Effluents, Dissolved solids, Groundwater, Water wells, Sampling, Sites, Water analysis, Vallecitos Valley, Alameda County.

A water-quality monitoring network is proposed to detect the presence of and trace the movement of radioisotopes in the hydrologic system in the vicinity of the Vallecitos Nuclear Center, Alameda County, Calif. The source of the radioisotopes is treated industrial wastewater from the Vallecitos Nuclear Center that is discharged into an unnamed tributary of Vallecitos Creek. The effluent infiltrates the alluvium along the stream course, percolates downward to the water table, and mixes with the native ground water in the subsurface. The average daily discharge of effluent to the hydrologic system in 1978 was about 100,000 gallons. In Vallecitos Valley, the Livermore Gravel and the overlying alluvium constitute the groundwater reservoir. There is no subsurface inflow from adjacent groundwater basins. Groundwater flow in the Vallecitos subbasin is toward the southwest. The proposed network consists of four surface-water sampling sites and six wells to sample the groundwater system. Samples collected monthly at each site and analyzed for tritium and for alpha, beta, and gamma radiation would provide adequate data for monitoring. (USGS)
W81-02685

SEAWATER INTRUSION AND POTENTIAL YIELD OF AQUIFERS IN THE SOQUEL-APTOS AREA, SANTA CRUZ COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
K. S. Muir.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-168759, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-84, October 1980. 29 p, 19 Fig, 3 Tab, 2 Ref.

Descriptors: *Saline water intrusion, *Groundwater movement, *Water pollution sources, *Groundwater availability, *California, Water yield, Aquifers, Water wells, Pumping, Water level fluctuations, Monitoring, Observation wells, Water storage, Water utilization, Soquel-Aptos area, Santa Cruz County.

Seawater has intruded the Purisima Formation in the interval 0-100 feet below sea level in the Soquel-Aptos area. It occurs in the central part of the area and extends inland about half a mile. The potential yields of the two principal aquifers in the Soquel-Aptos area are 4,400 acre-feet per year from the Purisima Formation and 1,500 acre-feet per year from the Aromas Sand. Pumping from the Purisima Formation, averaging about 5,400 acre-feet per year since 1970, has caused water levels along the coast to decline below sea level and has allowed seawater to enter the aquifer. Seawater intrusion and ground-water storage could be monitored in all depth zones by expanding the observation-well network to include a number of shallow wells, one deep well inland from the coast, and three deep wells along the coast. (USGS)
W81-02690

CHEMICAL AND MINERALOGICAL COMPOSITION AND BEHAVIOR OF THE MANCOS SHALE AS A DIFFUSE SOURCE OF SALTS IN THE UPPER COLORADO RIVER BASIN,
California Univ., Davis. Dept. of Land, Air and Water Resources.
V. P. Evangelou.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-197626, Price codes: A11 in paper copy, A01 in microfiche. Ph.D. Dissertation, March, 1981. 198 p, 57 Fig, 26 Tab. (Water Resources Center Project UCAL-WRC-W-562). OWRT-B-201-CAL(1).

Descriptors: *Salinity, *Mineralogy, *Shales, Saline soils, Soil chemical properties, Water quality, *Colorado River Basin, Colorado River, Dolomite, Magnesium, Carbonates, West Salt Creek watershed, Colorado, Mancos Shale.

Previous investigations relative to salinity in the upper Colorado River Basin have mostly dealt with the total quantities of dissolved solids moving into the Colorado River. Soluble components resulting from dissolution of mineral species have been studied as separate physical entities in the Colorado River, in tributaries of the river and in the Mancos Shale formation. Thus, the Mancos shale itself has been treated basically as an inert material without consideration of possible interactions between soluble and insoluble phases. The purpose of this investigation is to conduct a thorough study of mineralogical and chemical characteristics of Mancos Shale itself has been treated basically as an inert material without consideration of possible interactions between soluble and insoluble phases. The purpose of this investigation is to conduct a thorough study of mineralogical and chemical characteristics of Mancos Shale within the West Salt Creek watershed, Colorado. The investigation focuses on the Mancos Shale as a source of soluble components contributing to salinity of the Colorado River including interactive relationships between the more soluble and less soluble mineral phases. The overall investigation has revealed the primary source of salts. Salts are derived from carbonates, calcite and dolomite, which upon contact with sulfuric acid (produced by the biological oxidation of pyrite), produce gypsum and magensium sulfates. A second source is gypsum as a product of the marine environment left after evaporation had occurred. A third source

is the continuous release of ions from such sources as dolomite, feldspars and micas. Finally, a fourth source is the leaching of ions of sodium and magnesium coming off the exchange complex of the unweathered Mancos Shale formation. (Snyder-California)
W81-02711

INTERCHANGE OF POLLUTANTS BETWEEN GROUNDWATER AND MINERAL STRATA AS APPLIED TO WASTE CHEMICAL DUMPS AND IN SITU COAL GASIFICATION SITES,
Missouri Univ.-Columbia. Dept. of Chemistry.
S. E. Manahan, P. Tobben, R. Gale, S. Hoeffner, and D. Bornhop.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198335, Price codes: A02 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri, Completion Report, March 15, 1981. 16 p, 9 Fig. OWRT-A-117-MO(1), 14-34-0001-0127.

Descriptors: *Water pollution, *Hazardous wastes, Coal, Coal gasification, Char, *Waste dumps, Organic pollutants, Phenols, Chemical wastes, *Groundwater pollution, *Leachates.

The overall objective of this research was to study the interchange of pollutants between minerals and groundwater produced as leachate from waste chemical dumps and as a by-product of in situ (underground) coal gasification. Particular emphasis was placed upon the development of methods to evaluate the chemical interaction between contaminated groundwaters and specific solids so that these methods could be applied to specific situations which other investigators might need to study. Of particular importance was the development of methods to obtain chemical data which in turn can be used to provide meaningful bases for modelling groundwater contamination. Water contaminated by vapor from laboratory-simulated in situ coal gasification was employed as a model polluted water. The solids used to sorb organics from this waster were subbituminous coal, non-activated coal char, activated coal char, and coal ash.
W81-02714

EFFECTS OF FLY ASH HEAVY METALS ON DAPHNIA MAGNA,
Missouri Univ.-Kansas City. Dept. of Biology.
M. S. Stern, and D. H. Stern.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198327, Price codes: A04 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri, Columbia, Completion Report, December 30, 1980. 58 p, 9 Fig, 9 Tab, 62 Ref. OWRT-A-120-MO(1), 14-34-0001-9027.

Descriptors: *Fly ash, *Heavy metals, Daphnia magna, Cadmium, Bioassay, Bioaccumulation, Coal, *Water pollution effects, *Aquatic life.

The purpose of this study was threefold: (1) To analyze the concentrations of heavy metals released from two different fly ashes in alkaline Missouri waters and their effect on the pH; (2) to determine the LC sub 50 and the chronic toxicity concentrations of fly ash that killed or impaired the reproductive capacity of Daphnia magna; and (3) to study the possible bioaccumulation of cadmium from fly ash by D. magna. Results of acute toxicity tests with D. magna indicated that older daphnids tolerated higher concentrations of fly ash better than did juveniles. Unfed adults were more susceptible to the effects of fly ash from Illinois coal than were fed ones. The fly ash from the western coal affected both juveniles and adults very differently from the Illinois ash. There were no significant differences in LC sub 50 values between juveniles and adults or between fed and unfed daphnids. Toxicity effects from the western coal fly ash were expressed almost immediately, while effects from the other ash required several days. The total number of young produced was the most sensitive indicator of chronic toxicity. A comparison of 96-h acute data with 21-d chronic data for both ashes were not significantly different, thus indicating that cummulative toxicity was apparently not significant for these ashes. Cadmium was accumulated from both fly ashes by Daphnia magna. The greatest accumulation occurred in unfed adult daphnids after 96-h exposure. There was no additional total accumulation of cadmium in the 21-d daphnids when compared to fed 6-d old daphnids.
W81-02715

SIMULATION OF THE DISTRIBUTION OF POLLUTED WATER IN RESERVOIRS FROM CONCENTRATED EMISSIONS,
Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).
A. V. Karaushev, and V. V. Romanovskiy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, August 27-30, 1979, Bloomfield Hills, Michigan, Environmental Protection Agency Report 600/9-80-033, July 1980. p 12

Descriptors: *Simulation analysis, *Pollutants, Pollutant load, *Reservoirs, *Lakes, *Eddy diffusion, Water pollution sources, Turbulent flow, Reservoirs.

In periods of calm without unidirectional currents, or when the surface is ice-covered, patches of pollutants may develop in lakes and reservoirs around the emission point. The patch moves as a result of emission of new waste water and turbulent diffusion. The process of diffusion of pollutants can be simulated on the basis of a differential equation for turbulent diffusion in cylindrical coordinates. The equation can be used to determine diffusion from emission points at the shore or in an open body of water, and for conservative or non-conservative substances. From this equation, equations are developed for the calculation of the field of concentration. A series of calculations is required for each interval of time under consideration, and for conservative substances, the concentration value is verified based on calculation of the total mass of the substance. (Brambley-SRC)
W81-02736

TRANSPORT OF MINING WASTE IN LAKE SUPERIOR,
Environmental Research Lab., Duluth, MN.
M. Sydor, G. E. Glass, and W. R. Swain.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, Aug 27-30, 79, Bloomfield Hills, MI. EPA Report 600/9-80-033, Jul 80. p 180-196, 9 Fig, 3 Tab, 14 Ref.

Descriptors: *Particulate matter, *Mine wastes, *Mathematical models, *Satellite technology, *Lake Superior, Sediment transport, Remote sensing, Upwelling, Water pollution, Suspended solids, Model studies, Plumes, Turbidity, Wind, Water currents.

The western arm of Lake Superior has a 100 km trough which extends along the Minnesota shoreline from Knife River, Minnesota where the trough is 180 m deep past Silver Bay, Minnesota, where depths range around 250 m. An average of 67,000 tons of fine iron ore tailings are discharged at Silver Bay into the lake every day. The transport of particulates can be investigated through use of remote sensing and numerical modeling. Fine particulates in lakes are identifiable through use of Landsat data. For one wind episode, transport and dispersal of a plume is simulated numerically for the actual wind and pressure conditions over the lake. The model results are subsequently compared with measurements of suspended solids and the remote sensing data for the plume. The results show that the direct transport of tailings cannot readily account for the episodes of high concentration of tailings at the Duluth water intake. In the second example, Landsat images for two consecutive days show discrete high concentration patches of tailings which appear to have upwelled during westerly winds. The successive images and current measurements at two station show that tailing spatches are transported in accordance with the results from numerical models. The patches appear to have originated from an upwelling near the Duluth water intake. The data for the intake show that the concentration of tailings in the patches exceeded 3 mg/l, a level which is an order of magnitude higher than the concentrations produced by the direct transport of turbidity to Duluth. (Moore-SRC)
W81-02739

THE TRANSPORT OF CONTAMINANTS IN LAKE ERIE,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
W. Lick.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, Aug 27-30, 79, Bloomfield Hills, MI. Environmental Protection Agency Report 600/9-80-033, Jul 80, p 261-305. 20 Fig, 33 Ref

Descriptors: Lakes, *Mathematical models, *Water pollution, *Water circulation, *Sediment transport, Model studies, Wave action, Pollutants, Sediment concentration, Stratification, Suspended sediments, *Lake Erie, Path of pollutants.

In order to understand more thoroughly and be able to predict the transport and fate of contaminants in lakes, the physical processes of transport have been studied in Lake Erie. The Western Basin of Lake Erie is quite wide but extremely shallow; because of this, and because of large inputs of sediments from the Maumee and Detroit Rivers and from shore erosion, there are large sediment concentrations and variations in sediment concentration in the Western Basin. These large variations in sediment concentration make the Western Basin particularly amenable to sediment transport analyses. The results of investigations of sediment resuspension and depostion, wave action, and currents were coupled with the sediment mass balance equation, and used to calculate the sediment concentrations during a specific, short-term event from 8 March to 11 March 1976 in the Western Basin. Near the southern shore there is reasonable agreement between the observations and calculations. In other areas, significant discrepancies exist. It is believed that the major reason for this is an inadequate knowledge of the sediment resuspension and deposition rates throughout the Basin. Transport in the Central Basin of Lake Erie during summer stratification was studied using a two-dimensional model. Calculations were made using a constant depth basin 100 km wide and 25 m deep, and a variable depth basin corresponding to a section across the Central Basin from Ashtabula, Ohio to Port Stanley, Ontario. The calculations are in reasonable agreement with observations. (Moore-SRC)
W81-02744

SELF-ORGANIZATION OF THREE-DIMENSIONAL MODELS OF WATER POLLUTION,
Akademiya Nauk URSR, Kiev.
A. G. Ivakhnenko, and G. I. Krotov.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, Aug 27-30, 79, Bloomfield Hills, MI. EPA Report 600/9-80-033, Jul 80, p 306-342. 13 Fig, 6 Ref.

Descriptors: *Model studies, *Mathematical models, *Water pollution, *Computers, Mathematical studies, Computer models, Path of pollutants.

The basic shortcomings of the deductive method is the need for a priori production of sufficiently complete and accurate information on the subject. Imprecise knowledge of even a single characteris-

tic can make the result of modeling incorrect. According to the theorem of incompleteness of Godel, the so-called internal criteria utilized by deductive mathematics, are not suitable for selection of the structure of a model of optimal complexity. In contrast, external criteria pass through a minimum as the model becomes increasingly complex, and this minimum defines a model of optimal complexity. The new inductive method of modeling, self organization of models by computer, is directed toward comprehensively decreasing the volume of a priori information required for modeling. In contrast to deductive mathematics, methods of self-organization are based on the use of external criteria: regularity, minimum bias, balance of variables, convergence of a multi-step prediction, and combined criteria. The principle of self-organization can be formulated as follows: with gradual complication of models, finds this minimum and indicates the unique model of optimal complexity. (Moore-SRC)
W81-02745

THE DISTRIBUTION OF SEDIMENTS AND PARTICULATE CONTAMINANTS FROM COMBINED SEWER AND STORM DRAIN OVERFLOWS I SEATTLE'S NEARSHORE WATERS,
Municipality of Metropolitan Seattle-METRO, WA.
R. D. Tomlinson, B. N. Bebee, R. G. Swartz, S. Lazoff, and D. E. Spyridakis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-155426, Price codes: A99 in paper copy, A01 in microfiche. In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, Nov 26-28, 1979, EPA Report EPA 600/9-80-056, December, 1980, p 115-146. 11 Fig, 5 Tab, 11 Ref.

Descriptors: *Storm runoff, *Storm wastewater, *Combined sewers, *Sediment distribution, *Lake Washington, Flow pattern, Particulate matter, Outfall sewers, Sediments, Heavy metals, Chlorinated hydrocarbons, Water pollution sources, Turbidity flow, Sediment transport, Storm sewers, Washington, Seattle area.

The locations and dimensions of the sewer outfalls in Lake Washington, Washington were mapped and measured. The map includes 23 emergency outfalls, 34 combined sewer outfalls (CSO's), 56 pump stations, and 240 storm drains (SD's). The analyses of sediments collected near 10 CSO's and 10 SD's revealed their widespread enrichment with heavy metals, chlorinated hydrocarbons and organic wastes. This was particularly true of the western nearshore region where all of the CSO's were located. Intensive comparative studies were carried out at one representative CSO and one SD having similar drainage basins and rainfall. Pollutant loading estimates indicated that, whereas mean storm concentrations for most parameters were greater for the CSO, the total annual loading was greater in most instances for the SD, due to its continuous and therefore greater volume of discharge. Effluent turbidity patterns and metals concentration ratios for effluent solids, settling particulates and sediments demonstrated significant local deposition of wastewater particles. The different effects of near-bottom, offshore transport and longshore advection cause different particulate dispersion patterns at the two sites. (Brambley-SRC)
W81-02753

EFFECTS OF COAL-ASH LEACHATE ON GROUND WATER QUALITY,
Tennessee Valley Authority, Chattanooga, TN.
J. D. Milligan, and R. J. Ruane.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-178535, Price codes: A07 in paper copy, A01 in microfiche. Interagency Energy/Environment R & D Program Report, Environmental Protection Agency Report EPA-600/7-80-066, March 1980. 125 p, 28 Fig, 24 Tab, 30 Ref, 4 Append.

Descriptors: *Powerplants, *Settling basins, *Leaching, *Groundwater pollution, Soil types, Monitoring, Wells, Clays, Sand, Dissolved solids, Interstitial water, Water pollution sources, Industrial wastes, Coal-ash leachate.

A field and laboratory project was performed to characterize coal-ash leachate and its attenuation by selected soil types at two TVA power plants. Groundwater monitoring wells were installed around the ash ponds, continuous soil-core samples were collected and analyzed periodically, and ash leachate was percolated through different clays and soils to study attenuation rates. Ash leachate is a chemically reducing solution, usually acidic, with a variable composition characteristically high in total dissolved solids and boron, iron, calcium, aluminum and sulfate. The different coal sources in the study produced ash leachate with similar characteristics. Interstitial water samples contained higher concentrations of metals and were more acidic than well samples. The flux of metals in the ash pond leachate was negligible compared with the ash pond surface overflow. Soils containing a large percentage of clay provide a better medium for attenuating metals from ash leachate than do sandy soils. The use of an inert gas pump provided a means of collecting anoxic groundwater samples while minimizing oxidation. (Brambley-SRC)
W81-02785

COLIFORMS AND FECAL STREPTOCOCCUS IN THE ILLINOIS RIVER AT PEORIA, 1971-1976,
Illinois State Water Survey, Urbana.
S. D. Lin, and R. L. Evans.
Report of Investigation 93, 1980. 32 p, 7 Fig, 11 Tab, 36 Ref, 2 Append.

Descriptors: *Illinois, *Bacterial analysis, *Water pollution, *Water analysis, Water sampling, *Coliforms, Streptococcus, Bacteria, Feces, Chemical analysis, Time series analysis, Dissolved oxygen, Chemical composition, River systems.

Water samples were collected weekly from the Illinois River at Peoria and examined for total coliform (TC), fecal coliform (FC), fecal streptococcus (FS), and 17 chemical and physical parameters. Indicator bacteria, rather than pathogenic organisms, are used because of the laborious technique and expensive equipment required to isolate pathogenic organisms from water. The presence of coliform bacteria in water is generally regarded as evidence of pollution by warm-blooded animals. In the data obtained from June 1971 to May 1976, wide ranges of bacterial densities were observed. About 44% of the time, FC densities complied with the Illinois Pollution Control Board limit of no more than 200 FC per ml. Compliance with the rule that no more than 10% of the samples in a 30-day period may exceed 400 FC per ml. was achieved only 25% of the time. The latter rule was found to be the limiting factor. Approximately 7.1% of the TC densities consisted of FC. Based on FC/TC ratio values, fecal contamination derived from human sources occurred in 41% of the June-August samples. The FC/TC values were low in the winter and spring months and high in the summer and fall. A time series analysis was performed to show the trends, seasonal and cyclical indexes, and irregular factors for the bacterial densities. A surprise was that the bacterial quality of the Illinois River at Peoria is as good as, if not better than, that in one of its tributaries, the Spoon River. This suggests that the assimilative capacity of stream waters and nonpoint sources are important factors in assessing the bacterial quality of streams. (Garrison-Omniplan)
W81-02792

POLLUTION OF SEA WATER AND MARINE SEDIMENTS IN COASTAL AREAS,
Orleans Univ. (France).
S. Berne, M. Marchand, and L. D'Ozouville.
Ambio, Vol 9, No 6, p 287-293, 1980. 6 Fig, 3 Tab, 10 Ref.

Descriptors: *Sediments, *Sea water, *Amoco Cadiz, *Oil spills, Persistence, Water pollution effects, *Path of pollutants, Bottom sediments, Sands, Coasts, Beaches, Degradation(Decomposition), Oil pollution, *France, Tidal waters, Seashores, Tidal marshes, Marshes, Bays.

The path of oil pollution from the Amoco Cadiz spill was followed by analysis of water samples collected at depths from 1 to 20 meters and at 5 meters above the bottom, at different locations, and on different dates throughout the year following the accident. Pollution was widespread during the first month, but had returned to normal values after 3 months except for certain bays and abers. Sediment pollution reflected hydrocarbon contents of the water samples and direction of drift of the slick. Hydrocarbon levels decreased toward the open sea. Although the medium to fine sands were well decontaminated within a year (down to an average of 27 ppm), muddy and slimy sediments remained polluted (above 1000 ppm). The highest concentration after 1 year was greater than 10,000 ppm, measured in Aber Benoit and Loc Majan Cove. It is expected that pollution here may last 10 years. Decontamination was more rapid in areas exposed to wind and wave action, slower in sheltered sections of the coastline, marshes and abers. Pockets of oil remain in areas where oil was deposited during very high tides and where oil was buried by deposited sand. A table of vulnerability lists type of coast and sediment characteristics, method of pollution, factors affecting self-cleaning and human cleaning, and probable duration of pollution. (Cassar-FRC)
W81-02808

DISTRIBUTION OF ACTIVATION PRODUCTS FROM BARSEBACK NUCLEAR POWER PLANT (SWEDEN) IN THE MARINE ENVIRONMENT. TEMPORAL AND SPATIAL VARIATIONS AS ESTABLISHED BY SEAWEED,
Lund Univ. (Sweden), Dept. of Radiation Physics.
S. Mattsson, R. Finck, and M. Nilsson.
Environmental Pollution (Series B), Vol 1, No 2, p 105-115, 1980. 5 Fig, 1 Tab, 7 Ref.

Descriptors: *Nuclear powerplants, *Aquatic plants, *Radioisotopes, Bioindicators, Path of pollutants, Nuclear wastes, Seaweeds, Metals, *Sweden, Phaeophyta, Absorption, Marine plants.

The brown seaweeds, Fucus vesiculosus and Fucus serratus, were used as bioindicators to study the path of radionuclides discharged into the marine environment from a nuclear power plant on the Swedish coast. The degree of uptake per activity unit is ordered as follows: Mn54, Co58, Co60, and Zn65 greater than Ag110 greater than Cr51. Half lives of Co58, Co60, Mn54, and Zn65 were close to 60 plus or minus 15 days during the summer. About 85-80% of the radioactive material followed the northbound water stream and 10-15%, the southbound stream. An equation was developed relating the activity with distance north of the power plant outfall. (Cassar-FRC)
W81-02815

STUDIES ON THE PHOTOCHEMICAL DECOMPOSITION OF ORGANOMERCURIALS--METHYLMERCURY(II) CHLORIDE,
Yokohama National Univ. (Japan). Inst. of Environmental Science and Technology.
M. Inoko.
Environmental Pollution (Series B), Vol 2, No 1, p 3-10, January, 1981. 4 Fig, 1 Tab, 3 Ref.

Descriptors: *Mercury, *Chemical degradation, Degradation(Decomposition), Organomercury compounds, Ultraviolet radiation, Path of pollutants, *Methylmercury, Chemical reactions, Radiation.

Aqueous solutions of methyl mercuric chloride (10, 100, and 1000 micrograms per liter) were irradiated with ultraviolet light to determine the reaction products and kinetics. The initial decomposition reaction formed methyl and mercury chloride free radicals, which in turn produced ethane, mercurous chloride, methyl chloride, and metallic mercury. The reaction followed first-order kinetics, with a reduction rate constant of 0.6 per hour. This laboratory-derived data must be extrapolated cautiously to a natural aquatic environment, because the many other constituents present in natural systems could affect results. (Cassar-FRC)
W81-02816

IMPACT OF A COMBINED SEWER OVERFLOW ON THE ABUNDANCE, DISTRIBUTION, AND COMMUNITY STRUCTURE OF SUBTIDAL BENTHOS,
Washington Univ., Seattle. Coll. of Fisheries.
For primary bibliographic entry see Field 5C.
W81-02820

CHEMICAL TREATMENTS OF SOIL TO DECREASE RADIOSTRONTIUM LEACHABILITY,
Oak Ridge National Lab., TN. Environmental Science Div.
For primary bibliographic entry see Field 5G.
W81-02826

THE UPTAKE OF LEAD AND COPPER BY SUBMERGED AQUATIC MACROPHYTES IN TWO ENGLISH LAKES,
Westfield Coll., London (England). Dept. of Botany and Biochemistry.
R. P. H. Welsh, and P. Denny.
Journal of Ecology, Vol 68, No 2, p 443-455, July, 1980. 2 Fig, 8 Tab, 28 Ref.

Descriptors: *Copper, *Lead, *Metals, *Aquatic plants, Plants, Sediments, Translocation, Heavy metals, *Lakes, Path of pollutants, Sorption, Ullswater Lake, Coniston Lake, Mine wastes, Water pollution sources, England.

Lead and copper uptake of 9 taxa of submerged aquatic macrophytes was studied in 2 English lakes, Ullswater and Coniston Water, both dimictic, temperate, oligotrophic-mesotrophic types. Mining of lead, zinc, and copper was begun about 1700 AD and continued to the present century. Mine seepage water still flows into these lakes. Lead and copper levels were 10-40 micrograms per cu dm in inflowing rivers and 0.5-5 micrograms per cu dm in the lake water. Sediment metal levels were higher and varied with site. Highest Pb level was 41,000 micrograms per gram dry weight; highest Cu level, 1500 micrograms per gram dry weight. Highest metal contents of plants were (in micrograms per gram dry weight): roots, Pb 1000 and Cu 720; shoots, Pb 1200 and Cu 510. It is believed that plants adsorb lead directly from the water, since some plants not rooted in the sediment took up lead. Copper uptake appears to be mainly from the roots with translocation to the shoots. Some absorption from water also can occur. (Cassar-FRC)
W81-02827

THE EFFECT OF BEEF FEEDLOT RUNOFF ON THE NITRATE-NITROGEN CONTENT OF A SHALLOW AQUIFER,
Kansas Agricultural Experiment Station, Manhattan. Evapotranspiration Lab.
R. V. Terry, W. L. Powers, R. V. Olson, L. S. Murphy, and R. M. Rubison.
Journal of Environmental Quality, Vol 10, No 1, p 22-26, January-March, 1981. 7 Fig, 3 Tab, 16 Ref.

Descriptors: *Aquifers, *Nitrates, *Feedlot runoff, Groundwater pollution, Water quality, Water analysis, Nitrogen, Farm wastes, Statistical analysis, Fluctuations, On-site investigations, *Kansas, Great Plains, Deep wells, Shallow wells.

The effects of different application rates of beef feedlot runoff on the nitrate-nitrogen levels of a shallow aquifer were evaluated in a subhumid region of the Great Plains of Kansas. Five application rates (0.0, 2.5, 5.1, 7.6 and 10.2 cm) were used in a randomized block design over 3 blocks. Samples of lagoon water were applied whenever precipitation produced sufficient runoff so that the lagoons had to be emptied. Every 3 months, water samples from a shallow and a deep well in each plot were collected and analyzed for nitrate-nitrogen. Statistical and graphical analysis of the data revealed that the nitrate-nitrogen levels in the shallow well of block 3 were as high as 46 milligrams/liter. Results from this well were also extremely variable. When the means from 12 quarters were statistically analyzed, only one significant treatment was found, in the seventh quarter. In most of the quarters, when the application rates were high, the lowest nitrate-nitrogen levels occurred in the aquifer. Parallel fluctuations were found in the nitrate-nitrogen levels using the dual well system. These findings suggested that some variations in nitrate-nitrogen levels stemmed from regional factors and not only from applied treatments. (Geiger-FRC)
W81-02828

GROUNDWATER CONTAMINATION POTENTIAL AT 21 INDUSTRIAL WASTE-WATER IMPOUNDMENTS IN OHIO,
Environmental Protection Agency, Columbus, OH Groundwater Div.
R. B. Stein, and J. A. Noyes.
Ground Water, Vol 19, No 1, p 70-80, January-February, 1981. 1 Fig.

Descriptors: *Groundwater pollution, *Industrial wastes, Water pollution sources, *Wastewater lagoons, Impoundments, Watersheds(Basins), Water table, Water sources, Groundwater basins, Aquifers, Water pollution, Water management(Applied), *Ohio.

Data are reported which deal with the current and potential contamination of groundwater sources at 21 industrial waste-water impoundments in Ohio. These 21 impoundment sites were selected by the House Subcommittee as having a high potential for contaminating local ground-water resources, as they are located in close proximity to the tops of highly permeable aquifer systems, thus allowing leakage or direct infiltration of wastes into the ground water; the waste waters in these impoundments may contain chemical substances classified as hazardous; there are no artificially placed barriers or liners beneath these impoundments; the sites are within one mile of a potential water supply well; and a very small percentage of industrial impoundments nationwide are being monitored for ground-water quality effects. These 21 industrial complexes include chemical companies, steel corporations, asphalt companies, incineration plants, a scrap lead plant, and other industrial classifications. The results of individual studies conducted at each of the impoundment sites are presented. (Baker-FRC)
W81-02841

WASTE IMPOUNDMENT ASSESSMENT IN THE STATE OF INDIANA,
SCS Engineers, Covington, KY.
J. J. Walsh, D. P. Gillespie, F. J. Schauf, and L. R. Silka.
Ground Water, Vol 19, No 1, p 81-87, January-February, 1981. 2 Fig, 9 Tab.

Descriptors: *Groundwater pollution, *Industrial wastes, Water management(Applied), Water pollution, Aquifers, Groundwater basins, Water sources, Water table, *Indiana, Watersheds(Basins), Impoundments, Water pollution sources, *Wastewater lagoons.

A study was made of waste impoundment in the state of Indiana for the purpose of inventorying waste impoundments located within the state and rating each waste impoundment on the basis of its ground-water contamination potential. The data that was gathered indicated that waste impoundments do possess high contamination potentials. One potential problem is the fact that the average depth to ground water at impoundment sites was only 13 ft, and about 20% of the impoundments were located on top of sand and gravel or limestone. In addition, 1,781 sites (94%) were located within 1 mile of water supplies; and 95 of these (5%) were located within 600 ft upgradient from drinking water wells. It is suggested that concrete examples of pollution of groundwater due to the surface impoundment of wastes will be reported as the use of the groundwater resources expands and new aquifers are tapped for use. (Baker-FRC)
W81-02842

BRINE POLLUTION AT FRESNO - TWENTY-SIX YEARS LATER,
K. D. Schmidt, J. A. Krancher, and G. Bisel, Jr.
Ground Water, Vol 19, No 1, p 12-19, January-February, 1981. 3 Fig, 4 Tab, 7 Ref.

Descriptors: *Brines, *Groundwater pollution, *Pollutants, Saline water, Ice-brine systems, Subsurface waters, Aquifers, Groundwater resources, Saline water intrusion, Water management(Applied), Chlorides, Halides, *Fresno, California.

In the early 1950's a case of groundwater pollution by chloride seeping into the water from pits and wells used for the disposal of waste waters at a Southern Pacific Railroad yard was reported. After the source of the pollution was identified, steps were taken to correct the situation. This paper reports on the situation as it stands now, 26 yr after the initial reports of the pollution. The point source of the pollution was an ice plant and water softening plant on the railroad yard. Discharge was stopped in 1953. In the late 1970's a high chloride content was still detectable in the ground water downgradient of the yard. The plume expanded both vertically and horizontally in the aquifer, from a volume of about 1,500 acre-feet in 1953 to 15,000 acre-feet in 1979. An inspection of chloride contents in water from specific wells in the late 1970's indicates that values from 150 to 175 mg/l were common immediately downgradient of the discharge site from the ice plant. One well producing water with a chloride content of 490 mg/l in the late 1970's was located about 1/2 mile from the former discharge site for the water softening plant. (Baker-FRC)
W81-02843

EVIDENCE FOR COMETABOLISM IN SEWAGE,
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
S. N. Jacobson, N. L. O'Mara, and M. Alexander.
Applied and Environmental Microbiology, Vol 40, No 5, p 917-921, November, 1980. 3 Tab, 21 Ref.

Descriptors: *Sewage bacteria, *Metabolism, *Herbicides, Model studies, Microbiological studies, Microbial degradation.

A method was developed to show cometabolism in models of natural ecosystems and to demonstrate cometabolism in sewage. The formation of metabolic products in high yield and the lack of incorporation of substrate carbon into cellular constituents are shown by the model. Samples of four C14 labeled herbicides (trifluralin, profuralin, fluchloralin, and nitrofen) were incubated with sewage aerobically and under discontinuous anaerobiosis for 88 days. Fresh sewage was added at intervals. In nonsterile sewage, products were formed from each of the herbicides. No products were formed in sterile sewage. Yield of recovered products was 87% for profluralin and more than 90% for fluchloralin and trifluralin. The number of products ranged from 6 for nitrofen to 12 for fluchloralin. When sewage microflora was concentrated 40-fold, the rate of conversion was greatly enhanced. Since the carbon substrate was not incorporated into the cells and the substrate was almost stoichiometrically converted to organic compounds, members of the microbial community were thought to be cometabolizing the test herbicides. (Small-FRC)
W81-02849

PERSISTENCE OF SPILLED OIL IN A TEXAS SALT MARSH,
Texas Univ. at Port Aransas. Marine Science Inst.
S. A. Macko, P. L. Parker, and A. V. Botello.
Environmental Pollution (Series B), Vol 2, No 2, p 119-128, 1981. 6 Fig, 19 Ref.

Descriptors: *Oil spills, *Coastal marshes, *Path of pollutants, Salt marshes, Water pollution sources, Oil pollution, Chemical properties, Tracking techniques, *Texas.

A crude oil spill at Harbor Island, Texas, was analyzed to determine the persistence of oil in a salt marsh system. There was a rapid loss of low molecular weight alkanes and more volatile aromatics. Concentrations of higher molecular weight n-alkanes (greater than C22) and of the alkyl-substituted naphthalenes and phenanthrenes de-

creased slowly to background levels. Over the 24-month period of the study, only slight differences were noted in the carbon isotopic composition of the whole crude extract when compared with original oil. The isotopic ratio was quite stable, which is indicative of its value for the tracking of petroleum pollutants. Concentration decreases were extrapolated to indicate that baseline levels will not be achieved until another five years. The spill investigated was a small spill (377 barrels of Brega crude) under harsh conditions. The possible longterm effects of a larger spill could be much more severe. (Small-FRC)
W81-02857

FATE OF CHROMIUM IN A TRIBUTARY OF THE IRAJA RIVER, RIO DE JANEIRO,
Universidade Federal do Rio de Janeiro (Brazil). Inst. de Biofisica.
W. C. Pfeiffer, M. Fiszman, and N. Carbonell.
Environmental Pollution (Series B), Vol 1, No 2, p 117-126, 1980. 2 Fig, 3 Tab, 18 Ref.

Descriptors: *Plating industry, *Chromium, *Industrial wastes, *Path of pollutants, Rio de Janeiro, *Brazil, Guanabara Bay, Iraja River, Water analysis, Heavy metals, Metals, Water pollution sources, Adsorption, Sediments.

Chromium released by an elctroplating industry into a tributary of the Iraja River, Rio de Janeiro, was determined in water, bottom sediments, and suspended particles during seven months at five stations. The average monthly Cr release was 537 kg, with concentrations varying from 370 to 4482 mg per ml. Hexavalent Cr represented 87% and trivalent, 13%. Total Cr concentrations in water dropped rapidly with distance from the outfall, from a mean of 54 and 80 ppm at the two closest stations to 6 and 0.23 ppm respectively, 300 and 600 meters downstream. Upstream levels were 0.14 ppm. Mean sediment samples varied from 1420 ppm Cr upstream to 24820 and 54300 ppm near the outfall and 5440 and 1700 ppm further downstream. Total Cr levels in suspended particles were 2210 ppm upstream, 15260 and 61070 near the outfall, and 27370 and 18620 downstream. The highest single Cr level was 227000 ppm in a suspended particle sample closest to the outfall. At 150 meters from the effluent release point, hexavalent Cr was predominant. At the station 300 meters downstream, domestic sewage entered the river, producing reducing conditions and a higher proportion of trivalent Cr. (Cassar-FRC)
W81-02865

DETECTION OF DIMETHYLNITROSAMINE AND DIETHYLNITROSAMINE IN MUNICIPAL SEWAGE SLUDGE APPLIED TO AGRICULTURAL SOILS,
Wright State Univ., Dayton, OH. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W81-02866

RELATIVE DEGRADATION RATES OF NTA, EDTA AND DTPA AND ENVIRONMENTAL IMPLICATIONS,
Princeton Univ., NJ. Dept. of Geological and Geophysical Sciences.
J. L. Means, T. Kucak, and D. A. Crerar.
Environmental Pollution (Series B), Vol 1, No 1, p 45-60, 1980. 4 Fig, 2 Tab, 46 Ref.

Descriptors: *Biodegradation, *Nitrilotriacetic acid, Ethylenediaminetriacetic acid, Diethylenetriaminepentaacetic acid, Chelation, *Heavy metals, Degradation(Decomposition), *Path of pollutants, Chemical reactions, Water pollution sources, Environmental effects, Organic compounds.

Chelating agents in the environment are undesirable, even at very low concentrations, because they solubilize and promote the transport of toxic and radioactive heavy metals in the ground and in natural waters. This study measured biodegradation rates of nitrilotriacetic acid (NTA), ethylenediaminetetraacetic acid (EDTA), and diethylenetriaminepentaacetic acid (DTPA) under different chemical conditions. Biodegradation rates decreased in the order NTA>EDTA = DTPA. Total degradation rates were DTPA>EDTA>NTA over the short term and NTA = DTPA>EDTA over the long term. Photolysis was noticeable in DTPA. Degradation rates decreased with decreasing oxidation-reduction potential and increased with addition of nutrients. After 173 days, total degradations of the three chelates were: greater than 99% for NTA and DTPA, and 92-99% for EDTA. The author suggests that chelates be destroyed by thermal or chemical means such as ozonation prior to discharge into the environment to prevent the danger of heavy metal mobilization. (Cassar-FRC)
W81-02868

ACID LAKES FROM NATURAL AND ANTHROPOGENIC CAUSES,
Academy of Natural Sciences, Philadelphia, PA. Div. of Limnology and Ecology.
R. Patrick, V. P. Binetti, and S. G. Halterman.
Science, Vol 211, No 4481, p 446-448, January 30, 1981. 7 Fig, 26 Ref.

Descriptors: *Coals, *Acidic water, *Lakes, *Acid rain, Water pollution sources, Water pollution effects, Fuels, Burning, Air pollution, Oil, Humic acids, Limnology.

Although the total amount of coal used in the U.S. has not significantly increased since 1920, changes in use patterns and pollution technology have altered the nature and quantity of stack emissions. This situation has produced acid rains and increasing acidity in many lakes in the northeastern U.S. Factors contributing to more acid emissions from fossil fuel burning are: (1) increase in the proportion of coal consumed by utilities, (2) gradual increase in use of fly ash precipitators, which remove the neutralizing effect of ash upon sulfur and nitrogen oxides, (3) the fact that sulfur scrubbers are only required on coal-burning plants built since 1975, (4) increase in the height of stacks, which introduces emissions high into the atmosphere where they can be readily transported for long distances (5) use of hotter combustion flames and resultant increase in nitrogen oxides emitted since 1975, (6) increase in use of petroleum in utilities and transportation where emissions are not controlled. Aquatic life in naturally acid lakes does not appear to suffer greatly from increases in acidity because the high humate content tends to chelate toxic metals released by the acid. However, lakes without this protective effect show more serious ecological disturbances. (Cassar-FRC)
W81-02870

BIODEGRADATION OF CHEMICALS OF ENVIRONMENTAL CONCERN,
Cornell Univ., Ithaca, NY. Dept. of Agronomy.
M. Alexander.
Science, Vol 211, No 4478, p 132-138, January 9, 1981. 1 Fig, 3 Tab, 91 Ref.

Descriptors: *Biodegradation, *Organic compounds, *Microorganisms, Chemical reactions, Persistence, Pesticides, Microbial degradation, Chemicals, Water pollution sources, *Path of pollutants, Environmental effects, Cometabolism, Chelation, Ecology, Reviews, Resistance, Enzymes, Soil contamination.

Microbial activity is the major process in complete degradation, or mineralization, of organic compounds such as pesticides in water and soil. This literature review describes the mechanisms of biological degradation, including cometabolism, and the toxic intermediates often formed from relatively innocuous precursors, e.g., methyl Hg from inorganic Hg in sediments. One table lists 16 types of reactions for transformation of environmentally important chemicals. Examples are dehalogenation (DDT), epoxidation (heptachlor), and sulfur oxidation (aldicarb). A second table lists 13 types of reactions for cleavage of organic chemicals. Examples of such chemicals are esters (malathion, phthalates) and S-S compounds (thiram). A third table shows examples of seven conjugation reactions involving, not degradation, but transformation. Examples are methylation of pentachlorophenol and N-nitrosation of dimethyl amine. Recalcitrant molecules, or molecules resistant to degradation (some synthetic polymers, pesticides, chlorinated aromatics, etc.) are discussed. These compounds may be esthetically undesirable, undergo biomagnification in the food chain, be transported in waters, and be very difficult to remove from the environment. Reasons for resistance to degradation are absence of oxygen in the medium, structure of the molecule, absence of any suitable organism or enzyme, low temperature, and complexing. (Cassar-FRC)
W81-02871

GLOBAL TRANSPORT OF ORGANIC POLLUTANTS: AMBIENT CONCENTRATIONS IN THE REMOTE MARINE ATMOSPHERE,
Texas A and M Univ., College Station. Dept. of Chemistry.
E. Atlas, and C. S. Giam.
Science, Vol 211, No 4478, p 163-165, January 9, 1981. 1 Fig, 2 Tab, 26 Ref.

Descriptors: *Enewetak Atoll, *Path of pollutants, *Organic compounds, Polychlorinated biphenyls, Air pollution, Baseline studies, Pesticides, Pacific Ocean, Water pollution sources, Oceans, Plasticizers, Chlorinated hydrocarbon pesticides, DDE, Chlordane, Dieldrin.

The levels of selected organic pollutants present in rain and air of Enewetak Atoll, North Pacific Ocean, an area remote from human and industrial activity, were measured in April to August 1979, to determine an ambient or minimum worldwide pollutant level. Some averaged pollutant concentrations in rainfall (in nanograms per liter) were as follows: polychlorinated biphenyls, less than 0.6; hexachlorobenzene, less than 0.03; alpha-hexachlorocyclohexane, 3.11; gamma-hexachlorocyclohexane, 0.51; chlordane, dieldrin, and DDE, less than 0.02; di-n-butyl phthalate, 21; and di(2-ethylhexyl)phthalate, 55. Atmospheric residence times showed that rain was not the only factor involved in removing pollutants from the air. Vapor phase deposition into the sea surface may be the controlling factor. (Cassar-FRC)
W81-02872

RELATIONSHIP BETWEEN HETEROTROPHIC BACTERIA AND PHYTOPLANKTON IN LAKE MERGOZZO AND LAKE BIWA,
Kyoto Univ. (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 2H.
W81-02881

PHOSPHORUS AND NITROGEN IN THE MEDITERRANEAN SEA: BUDGETS AND POTENTIAL FERTILITY. (LE PHOSPHORE ET L'AZOTE EN MER MEDITERRANEE, BILANS ET FERTILITE POTENTIELLE),
Station Marine, Villefrance-sur-Mer (France). Lab. de Physique et Chimie Marines.
J. P. Bethoux.
Marine Chemistry, Vol 10, No 2, p 141-158, 1981. 6 Fig, 1 Tab, 21 Ref.

Descriptors: *Phosphorus, *Nitrogen, *Mediterranean Sea, Nutrients, Water pollution sources, Cycling nutrients, Path of pollutants.

Terrestrial discharges of phosphorus and nitrogen into the Mediterranean Sea are considered along with the calculated values of water fluxes. Only low concentrations of phosphorus are found in the surface layers of the water. The phosphorus cycle in the Mediterranean is characterized by the transfer of the terrestrial and Atlantic influxes from the surface to the intermediate and deep layers. The geographic distribution of terrestrial discharges is extremely asymmetric, with vertical movements of water masses in specific areas inducing an important hydrologic recycling of the phosphorus. The potential fertility is estimated from the local surface phosphorus flows and from the hydrologic recycling. The nitrogen budget in the Mediterranean should be comparable to that of phosphorus, as the geographical variations of the nitrate concentrations in the deep waters and the distribution of terrestrial discharges are similar. However, the relatively low values of terrestrial discharges of

nitrogen that have been proposed do not allow a balance of this nutrient unless a high concentration is introduced in the Atlantic surface waters. (Baker-FRC)
W81-02891

HYDROCARBON-UTILISING MICRO-ORGANISMS FROM DONA PAULA BAY, GOA,
National Inst. of Oceanography, Panaji (India).
N. B. Bhosle, and S. Mavinkurve.
Marine Environmental Research, Vol 4, No 1, p 53-58, 1980-81. 4 Tab, 14 Ref.

Descriptors: *Microorganisms, *Bacteria, *Organic compounds, Oil pollution, *Hydrocarbons, Biodegradation, Water pollution treatment, Water pollution sources, Path of pollutants, Marine microorganisms, Yeasts, Oil spills, Goa, Dona Paula Bay, *India.

Twenty-three strains of bacteria and one yeast were isolated from water and sediment samples in Dona Paula Bay, Goa. Most predominant were Vibrio and Pseudomonas. These were grown on a variety of hydrocarbons and hydrocarbon mixtures--kerosene, motor oil, Arabian Sea crude, furnance oil, aviation turbine fuel, raw naphtha, gasoline, diesel, tar, n-pentane, n-hexane, cyclohexane, n-heptane, benzene, xylene, toluene, naphthalene, and anthracene. Bacillus, Candida, and Arthrobacter sp. utilized the greatest number of hydrocarbon materials. Arabian Sea crude and kerosene supported the growth of most of the isolates. Pentane, benzene, naphthalene, and anthracene accelerated growth of most of the microorganisms. (Cassar-FRC)
W81-02893

NON-RADIOLOGICAL ENVIRONMENTAL IMPLICATIONS OF NUCLEAR ENERGY,
Biswas and Associates, Oxford (England).
For primary bibliographic entry see Field 5C.
W81-02895

USE OF SYNTHETIC DETERGENTS IN MALAYSIA,
Malaya Univ., Kuala Lumpur (Malaysia).
For primary bibliographic entry see Field 5C.
W81-02896

HEALTH HAZARDS AND POLLUTION FROM OPEN DRAINS IN A NIGERIAN CITY,
Ibadan Univ. (Nigeria). Dept. of Preventive Medicine and Social Medicine.
M. K. C. Sridhar, P. A. Oluwande, and A. O. Okubadejo.
Ambio, Vol 10, No 1, p 29-33, 1981. 4 Fig, 4 Tab, 20 Ref.

Descriptors: *Public health, *Waste water(Pollution), *Domestic wastes, Diseases, Drains, Sewage disposal, Water pollution sources, Ibadan, *Nigeria, Wastes, Municipal wastes, Sewage, Water quality, Cities, Microbiology, Coliforms, Parasitism, Human diseases.

Wastewater from kitchens, bathrooms, and laundries in the city of Ibadan, Nigeria, is commonly carried in open drains, which are a source of environmental pollution and health hazards. Samples of waste water were collected in areas of high-, medium-, and low-density population. Most severe pollution was seen in the samples from the most crowded sections of the city, 350-430 persons per hectare. Ranges of results were as follows: pH, 6.4-7.5; turbidity, 50-1000 Fermazin units; total solids, 112-11,544 mg per liter; suspended solids, 20-1,150 mg per liter; 4 hour permanganate value, 25-61.9 mg per liter; BOD, 30-980 mg per liter; dissolved oxygen, 0-0.6 mg per liter; NH3, 20-800 mg per liter; mean total coliforms, 18,000,000 per 100 ml; and fecal coliforms, 800-16,000 per 100 ml. Sediment samples (500 g) from one sandy open drain showed an average of 3,400 Ascaris sp. ova and 300 hookworm larvae. Waste water samples contained a variety of pathogens and parasites: Staphylococcus aureus, fecal coliforms, Trichomonas sp., Balantidium coli, Giardia intestinalis, Entamoeba histolytica, Candida albicans, Ascaris sp. ova, larvae of hookworm Ancylostoma sp., miracidia of Schistosoma sp., and Stronglyloidess sp. Although waste water drains are capable of self-purification after flowing 16-40 km, the drains of Ibadan enter streams before much improvement in quality occurs. This situation produces severe stream and groundwater pollution. (Cassar-FRC)
W81-02900

5C. Effects Of Pollution

HYDROCHEMICAL AND GEOPHYSICAL INVESTIGATION OF THE EFFECTS OF FLY-ASH DISPOSAL ON GROUNDWATER,
Wisconsin Univ.-Madison. Water Resources Center.
D. S. Cherkauer, and W. F. Kean.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-197592,Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report WIS WRC 80-12, 1980. 85 p, 32 Fig, 7 Tab, 43 Ref, 1 Append. OWRT-A-077-WIS(1), 14-34-001-8053, 9053.

Descriptors: *Groundwater, *Chemical wastes, *Water pollution effects, *Fly ash, *Leachate, *Landfills, Pollutant identification, Geophysics, Wisconsin, Waste disposal, Earth fill, Solid wastes, Water pollution souces, Water pollution, Water quality, Calcium, Magnesium, Sodium, Potassium, Iron, Manganese, Nickel, Zinc, Inorganic compounds, Research and development, Analytical techniques.

The effects of landfill disposal of fly ash on groundwater and methods useful to monitoring such impact were investigated. Hydrochemical and geophysical monitoring of a fly ash landfill site in Ozaukee County, Wisconsin and related laboratory experiments were carried out. The landfill disposal method is the only method presently used in Southeastern Wisconsin. Landfill disposal of fly ash allowed generation of an acidic leachate highly concentrated with Ca, Mg, Na, K, sulfate, and several metals (Fe, Mn, Ni, Zn). Fly ash disposal in contact with an unconfirmed sand aquifer resulted in development of a traceable leachate plume in the aquifer. The plume contained water severely contaminated with Ca, Mg, and sulfate, and bicarbonate concentrations were high due to dissolution of the dolomite-rich sand. Leachate contamination was released in a pronounced 'first flush' pattern immediately after disposal of new ash. Reactions between the carbonate-rich aquifer sand, marsh peat, and the leachate rapidly ameliorated the contamination effects. Heavy metals were, in general, undetected outside the fill boundaries. Major ions (except ca and bicarbonate) were rapidly reduced in concentration downflow. Electrical resistivity methods were useful for identifying the extent of leachate contamination in a shallow aquifer and for tracing its migration and seasonal changes. (Zielinski-IPA)
W81-02651

MECHANISMS BY WHICH ACID PRECIPITATION PRODUCES EMBRYONIC DEATH IN AQUATIC VERTEBRATES,
Cornell Univ., Ithaca, NY.
F. H. Pough.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198392, Price codes: A02 in paper copy, A01 in microfiche. Center for Environmental Research, Cornell University, Completion Report. March, 1981. 13 p, 4 Tab, 21 Ref. OWRT-A-077-NY(2), 14-34-0001-7068, 8034, 9034, 0134.

Descriptors: Acid precipitation, Embryology, *Amphibians, Experimental studies, *Acid rain, *Toxicity, Fish, Frogs, Ponds, *Lakes, Embroyonic growth stage, Hydrogen ion concentration, Ambystoma jeffersonianum, Ambystoma maculatum, Rana sylvatica, Xenopus laevis, Teratogenesis.

Fourteen species of amphibians show a general similarity in their tolerance of acid media during embryonic development. More than 85% mortality is produced by pHs of 3.7 to 3.9 and more than 50% mortality occurs at pHs of 4.0 or less. Similar values have been reported for fishes. The sensitivity of amphibian embryos to acidity is greater in late stages of their development than it is during the initial cleavage of the embryos. The teratogenic effects of acidity appear to be the result of damage to the superficial tissues of the embryo. A similar response occurs in fish embryos. Because of the similarity of sensitivity and response to acidity of fishes and amphibians, the latter animals are suitable experimental models for investigations of the details of acid resistance. Controlled breedings of African clawed frogs (Xenopus laevis) indicated that the offspring of some pairs of parents were more resistant to acidity than those of other pairs. Wild populations of spotted salamanders (Ambystoma maculatum) breeding in some ponds in the Ithaca, New York, region have probably been exposed to increasingly acid conditions for the past three decades (10 or more generations). In the most acid ponds more than 70% of the embryos die before hatching. Despite the intensity and duration of this selection, it was not possible to demonstrate any difference in sensitivity to acidity between eggs collected from acidic and neutral breeding sites.
W81-02716

THE NITROGEN CYCLE IN THE DELAWARE RIVER,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
R. B. Tiedemann, T. J. Tuffey, J. V. Hunter, and J. Cirello.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198400. Water Resources Research Institute, Rutgers University Completion Report, February, 1981. 67 p, 12 Fig, 24 Tab, 10 Ref. OWRT-B-054-NJ(2), 14-31-0001-5091.

Descriptors: *Nitrogen cycle, *Nitrification, *Estuarine environment, Delaware, *Bacterial analysis, Bacteria, Estuaries, Environment, River systems, Rivers, Nitrogen fixing bacteria, Aquatic bacteria, Aquatic life, Aquatic populations, Water quality, Nitrogen compounds, Nitrites, Nitrates, Imparied water quality, Water pollution effects, *Delaware River.

The research scope was divided into two phases: (1) a review of existing literature on the estuary concerning nitrification; (2) transfer of ammonia and nitrate across the mud-water interface. The first phase was expanded to include studies of the role of nitrification inhibition and particulates. Indirect evidence (nitrogen species data) obtained from U.S. Environmental Protection Agency Storet data indicated that significant nitrification occurs within the estuary. These observations were confirmed by the present study. Number counts of nitrifying organisms indicated that the changes observed in the ammonia-nitrogen, nitrite-nitrogen, and nitrate-nitrogen concentrations could be attributed to the organisms present, due to the long retention times. Nitrification was observed to proceed at a maximum rate during June-October and a zone of nitrification inhibition was observed in the vicinity of the city of Philadelphia. Two nitrifying regions were identified: one in the upper estuary, one in the lower, with the latter shifting upstream during warm water months. Of the chemical and microbiological parameters measured, only pH, dissolved oxygen and suspended solids varied considerably with estuary location and/or depth. (Zielinski-IPA)
W81-02727

A MODEL APPROACH TO ESTIMATING THE EFFECTS OF ANTHROPOGENIC INFLUENCES ON THE ECOSYSTEM OF LAKE BAIKAL,
Rostov-on-Don State Univ. (USSR). Inst. of Mechanics and Applied Mathematics.
A. B. Gorstko, Y. A. Dombrovskiy, V. V. Selyutin, F. A. Surkov, and A. M. Nikanorov.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet

Symposium on the Use of Mathematical Models to Optimize Water Quality Management, August 27-30, 1979, Bloomfield Hills, Michigan. Environmental Protection Agency Report 600/9-80-033, July 1980. p 71-84, 4

Descriptors: *Water pollution sources, *Ecosystems, Experimental data, Prediction, Water use, Surface runoff, Precipitation, Lake morphology, *Model studies, Lake Baikal, *Russia.

At present, anthropogenic effects on the ecosystem of Lake Baikal are minimal. Possible effects can be judged using models for long-term prediction. The lake is used as a source of water for consumption, the culture and harvesting of fish and for recreation. The major pollutant sources are surface runoff and atmospheric precipitation. Numerical hydrodynamic calculations and field observations of current speed and direction were used in the modeling of the hydrochemical regime. The basis of the models for the dynamics of the concentrations of substances entering the lake is the equation of turbulent diffusion of a non-conservative impurity. Two groups of equations are used to develop a model based on the dynamic balance method, one group reflecting the productive nature of the system and the other the dynamic nature. In addition to its primary function as a predictive instrument, the model can act as a connecting link between various branches of limnologic study of Lake Baikal, and indicate areas where information is incomplete. (Brambley-SRC)
W81-02734

A REVIEW OF SOME METHODS AND PARAMETERS USED IN ASSESSING EFFECTS OF WATER INTAKES ON FISH POPULATIONS,
Michigan Univ., Ann Arbor. School of Natural Resources.
R. L. Patterson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, August 27-30, 1979, Bloomfield Hills, MI. EPA Report 600/9-80-033, July, 1980, p 237-251, 1 Fig, 16 Ref.

Descriptors: *Fish populations, *Mortality, *Intakes, *Entrainment, *Population dynamics, Aquatic populations, Larvae, Aquatic habitats, Environmental effects, Food chains.

The direct effects of water intakes on fish populations consist of entrainment, and impingement. Direct effects upon sections of the aquatic habitat may be triggered by withdrawal of excessive quantities of water, which may affect recruitment or survival of the species inhabiting the area. Indirect effects include: imbalance in food chains due to size or species selectivity in cropping, and the loss in new recruits in subsequent years due to cropping of individuals in the present year. Factors important in assessing the effects of water intakes include: historical review, mortality rates of entrained larvae, size distribution of entrained larvae, total number of entrained larvae, total number and size distribution of impinged individuals, percent reduction in size or age classes due to entrainment and impingement, and the vulnerability of larval populations to entrainment. An assessment of direct effects is complicated by the need to obtain larval production and natural mortality estimates as well as estimates of standing crops of other size classes, and the differential impact that a particular water intake may exert if it selectively crops size classes, and the implications of this differential cropping of size classes upon the percent reduction in the population. (Moore-SRC)
W81-02742

A SPATIALLY-SEGMENTED MULTI-CLASS PHYTOPLANKTON MODEL FOR SAGINAW BAY, LAKE HURON,
Environmental Research Lab.-Duluth, Grosse Ile., MI. Large Lakes Research Station.
V. J. Bierman, Jr., and D. M. Dolan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, Aug 27-30, 79, Bloomfield Hills, MI. EPA Report 600/9-80-033, Jul 80, p 343-365. 16 Fig, 1 Tab, 5 Ref.

Descriptors: *Phytoplankton, *Eutrophication, *Model studies, *Mathematical models, *Lake Huron, Water quality, Water chemistry, Zooplankton, Nutrients, Phosphorus, Nitrogen, Silicon, Chlorophyll, Chloride, Water pollution.

The principle water uses in Saginaw Bay include municipal and industrial water supply, waterborne transportation, recreation, commercial fishing, and waste assimilation. These uses are severly impacted by the considerable quantities of waste discharges and runoff to the bay. The purpose of the modeling effort was to develop a deterministic phytoplankton simulation model that could describe the cause-effect connection between external nutrient loading and phytoplankton growth in Saginaw Bay. Analyses were conducted for 22 different physical-chemical variables, including phosphorus, nitrogen, silicon, chlorophyll, chloride, temperature, and Secchi depth. Biological measurements included species identification and number concentrations for both phytoplankton and zooplankton. These field data are used to perform a preliminary calibration for the phytoplankton modeling effort. The field data indicate that there are large gradients in water quality among five spatial segments in Saginaw Bay. These gradients have a strong impact on the model development effect because it is difficult to obtain a unified set of kinetics which can describe phytoplankton dynamics simultaneously in all five segments. (Moore-SRC)
W81-02746

URBAN RUNOFF RECEIVING WATER IMPACTS: PROGRAM OVERVIEW AND RESEARCH NEEDS,
Municipal Environmental Research Lab., Edison, NJ. Storm and Combined Sewer Section.
R. Field, and R. Turkeltaub.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-155426, Price codes: A99 in paper copy, A01 in microfiche. In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, Nov 26-28, 79, EPA Report EPA 600/9-80-056, Dec 80, p 8-30. 11 Fig, 4 Tab, 22 Ref.

Descriptors: *Storm runoff, *Storm wastewater, *Combined sewer overflows, *Urban runoff, Research priorities, Water pollution sources, Water pollution control, Dissolved oxygen, Pathogens, Nutrients, Aquatic life, Poisons, Water quality standards, Monitoring, High flow.

Uncontrolled stormwater and combined sewer overflows are a major cause of pollution of receiving waters. Data on the environmental impacts of urban stormwater and combined sewer overflow are being gathered by projects of the Storm and Combined Sewer Program of the EPA's Municipal Environmental Research Laboratory as a first step in developing control needs and a methodology to quantify pollutant stress and evaluate the impact in relation to receiving water standards and desired uses. Ongoing projects include studies on dissolved oxygen depletion with particular reference to sediment oxygen demand; pathogen concentrations; nutrients; aquatic biological communities; and toxic substances. Control methodology will be based on some site-specific factors, but general studies are valuable. They include projects to review case studies of documented receiving water impacts; to develop a methodology for defining criteria for wet-weather water quality standards; and to develop a user's manual/guidebook for wet-weather flow quality and quantity monitoring. (Brambley-SRC)
W81-02748

AN APPROACH FOR ASSESSING THE WATER QUALITY SIGNIFICANCE OF CHEMICAL CONTAMINANTS IN URBAN LAKES,
Colorado State Univ., Fort Collins.
G. F. Lee, and R. A. Jones.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-155426, Price codes: A99 in paper copy, A01 in microfiche. In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, EPA Report EPA 600/9-80-056, Dec 80, p 32-57. 6 Fig, 26 Ref.

Descriptors: *Urban runoff, *Eutrophic lakes, Phosphates, *Nutrients, *Contamination, Water pollution control, Eutrophication, Storm water, Water quality, Macrophytes, Dredging, Chemical precipitation, Nitrogen, Lakes, Urban lakes.

Increasing pressures are being placed on water pollution control agencies to manage water quality in urban lakes. A major problem to be overcome is the excess nitrogen and phosphorus which enter the lake from urban runoff. Since only 10-30% of the particulate phosphorus present in urban stormwater is likely to become available to affect algal growth, attention should be directed to the soluble orthophosphate component, yet most current stormwater drainage control programs are directed to particulate control. A study conducted by the Organization for Economic Cooperation and Development which models eutrophication can be used to describe the nutrient load-response relationships for the urban lakes and to estimate the magnitude of water quality improvement that will arise as a result of altering the nutrient loads in phosphorus limited urban lakes. Improved water quality may be achieved by: removal of debris and trash left by users of the area; control of macrophytes by herbicides or harvesting; dredging of sediment; and direct addition of alum to precipitate phosphate in incoming waters. (Brambley-SRC)
W81-02749

THE EFFECT OF URBAN STORMWATER RUNOFF ON THE WATER QUALITY OF LAKE JACKSON, FLORIDA,
Florida State Univ., Tallahassee. Dept. of Oceanography.
C. Byrne, C. R. Donahue, and W. C. Burnett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-155426, Price codes: A99 in paper copy, A01 in microfiche. In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, EPA Report EPA 600/9-80-056, December 1980, p 58-71. 4 Fig, 2 Tab, 15 Ref.

Descriptors: *Urban runoff, Storm surges, *Storm runoff, *Lakes, *Hydrocarbons, Petroleum products, Particulate matter, Dissolved solids, Water quality, Water pollution sources, Water sheds, *Lake Jackson, Florida.

The presence of petroleum hydrocarbons in the stormwater runoff to the Meginniss Arm of Lake Jackson during a storm event was investigated and the concentration and forms of these hydrocarbons assessed as they move through the discharge channel and into the lake. Water grab samples were taken at intervals after the storm at four locations on 27 November, 1978. Dissolved and particulate hydrocarbon fractions were determined using gas-liquid chromatography. The dissolved hydrocarbon fraction ranged from 18-71 ppb, with a significant maximum 2 hours after the storm event. The total particulate hydrocarbon concentrations ranged from 37-16,365 ppb, with the maximum at the beginning of the storm, and a secondary maximum 2 hours into the storm. The presence of petroleum hydrocarbons is indicated by the low Carbon Preference Index (<1.5) and the occurrence of an unresolved hydrocarbon envelope in the chromatograms. Comparison of the runoff from this highly urban watershed with that from a primarily forest-agriculture watershed may make possible a separation of the biogenic and anthropogenic pollution sources. This information could contribute to determination of a mass balance for hydrocarbons in the lake. (Brambley-SRC)
W81-02750

A COMPARISON OF RAIN-RELATED PHOSPHORUS AND NITROGEN LOADING FROM URBAN, WETLAND, AND AGRICULTURAL SOURCES,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
R. P. Glandon, F. C. Payne, C. D. McNabb, and T. R. Batterson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-155426, Price codes: A99 in paper copy, A01 in microfiche.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, EPA Report EPA 600/9-80-056, Dec 80, p 72-88. 4 Fig, 3 Tab, 14 Ref.

Descriptors: *Urban runoff, *Agricultural runoff, Phosphorus, Rainfall-runoff relationships, Nitrogen, *Skinner Lake, Indiana, *Lake Lansing, Michigan, *Nutrients, Watersheds, Limiting nutrients, Eutrophication, Lakes, Phytoplankton, Water pollution sources, Water pollution control, Lake Michigan basin.

To compare the watershed types with respect to the ability to maintain phytoplankton productivity in a lake throughout the summer, comprehensive watershed studies were conducted in Lake Lansing and Skinner Lake in the Lake Michigan drainage system from March to October, 1979. During that interval, large differences in storm-related nutrient loading were measured from urban, wetland, and agricultural sources. Eliminating runoff due to melt of the snow pack, it was found that rain-related discharge from the urban area studied was 0.578 kg total-P and 3.688 kg total-N per hectare. Rain induced runoff from marshes in the same drainage basin transported 0.023 kg total-P and 0.585 kg total-N per hectare. Rainfall of approximately the same amount caused runoff from agricultural land of 0.180 kg total-P and 5.965 kg total-N per hectare. Algae of both lakes were phosphorus limited; nitrogen was present in excess. Using constants from Nichols-Dillon relationships in the literature regarding phosphorus, phytoplankton biomass, and secchi disc transparencies, the urban input of phosphorus per hectare of drainage was sufficient to bring 0.96 ha-m lake water to undesirable algal bloom status. Similarly, marsh input per hactare would bring an estimated 0.04 ha-m into bloom. By the same calculation, storm-related agricultural runoff would result in 0.30 ha-m of lake water becoming undesirably rich in algae. Knowing the number of hectares in these types of catchment and the volume available in a particular lake for phytoplankton production, decisions regarding cost-effective treatment of rain-related discharge can be made. (Brambley-SRC)
W81-02751

IMPACTS OF STORMWATER RUNOFF ON A FLORIDA LAKE ECOSYSTEM: EFFECTS ON WATER QUALITY AND BIOTA,
Marine Environmental Sciences Consortium, Dauphin Island, AL.
E. C. Blancher, II.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-155426, Price codes: A99 in paper copy, A01 in microfiche.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, EPA Report EPA 600/9-80-056, December, 1980, p 90-114. 4 Fig, 11 Tab, 29 Ref.

Descriptors: *Lake Conway(FL), *Stormwater runoff, *Nutrients, Nitrogen, Phosphorus, *Mesotrophic lakes, Eutrophication, Algal growth, Zooplankton, Water pollution sources, Water quality, Storm seepage, Precipitation, *Florida.

The Lake Conway system is an interconnected series of three lakes with similar physical, chemical and biological features which vary in stormwater loadings and are relatively free of other pollution inputs. It is therefore suitable for studying the effect of stormwater on water quality and biota. Both nitrogen (2.6 g-N per sq. m per year) and phosphorus (0.22 g-P per sq m per year) inputs were within the range of loadings that leads to mesotrophic conditions. The major external sources of both elements were atmospheric inputs, stormwater runoff and subsurface seepage. Multivariate analysis of water quality data by discriminant analysis showed differences among the three lakes of the Conway system. Seasonal trends in several water quality indicators varied concomitantly with changes in external nutrient loadings, especially with those from residential stormwater runoff. Those lakes that had a proportionately larger share of phosphorus loadings from stormwater runoff showed a degradation in water quality. Strong linear relationships were found between watershed area to lake area ratios and stormwater phosphorus loadings; stormwater phosphorus loadings and Secchi disk transparency; and chlorophyll a and total zooplankton numbers. Increased stormwater flow into the lakes is associated with decreased water quality, and larger algal and zooplankton populations. (Brambley-SRC)
W81-02752

THE ECOLOGICAL EFFECTS OF URBAN RUNOFF ON STREAM COMMUNITIES,
Tetra Tech, Inc., Lafayette, CA.
D. B. Porcella.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-155426, Price codes: A99 in paper copy, A01 in microfiche.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, EPA Report EPA 600/9-80-056, December 1980, p 147-166. 4 Fig, 5 Tab, 20 Ref.

Descriptors: *Urban runoff, *Storm runoff, *Ecological effects, *Ecosystems, *Stream biota, *Stream pollution, Streams, Evaluation, Aquatic plants, Macroinvertebrates, Monitoring, Water pollution sources, Water pollution control.

Materials in urban runoff impact streams in several specific and unique ways that distinguish those impacts from other linked systems. A literature review of the ecological effects of urban runoff on streams indicates a dearth of principles for evaluating the impact of urban runoff or any pollutant on streams, and a serious lack of studies that determine urban runoff impacts on communities of stream ecosystems. It can be concluded from the case studies that macroinvertebrates and periphyton seem to be effective for monitoring impulse impacts on streams; that diversity and biomass are often used for the analysis of monitoring data but they are not always adequately sensitive; and that water quality variables do not always reflect stream impacts directly but the biota must also be assessed. Consideration of three studies of ecological effects of storm runoff lead to the hypothesis that large scale variations and instabilities of stream pollutant input and concentration would result in lesser impact to stream communities than steady imputs. Time and space measurements of structurally and functionally defined biomass, photosynthesis, respiration, and diversity would be used to determine the ecological impact of the runoff loadings, leading to the development of management strategies. (Brambley-SRC)
W81-02754

ANALYSIS OF RECEIVING STREAM IMPACTS ON THE MILWAUKEE RIVER,
EcolSciences, Inc., Milwaukee, WI.
T. L. Meinholz.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December 1980. p 168-196, 16 Fig, 1 Tab.

Descriptors: *Combined sewers, *Storm sewers, *Model studies, *Combined sewer overflows, *Dissolved oxygen, Scour, Lake Michigan, Bottom sediment, Prediction, Evaluation, Water pollution control, Cost-benefit analysis, Coliforms, Monitoring, *Milwaukee River, Wisconsin.

Extensive monitoring and modeling efforts were performed to quantify the receiving water impacts of the combined sewers on the Milwaukee River, Milwaukee, Wisconsin. The models used were the EPA's SWMM and the Corps of Engineers' STORM models. The inflow of Lake Michigan into the river was a major difficulty in the modeling. Final model calibration using a linearly decreasing flux was found to match the continuous dissolved oxygen (DO) data generated during two years of record. Field monitoring showed that the cause of the large DO sags in the lower reaches of the river following runoff events are due to bottom sediments scoured out by the submerged combined sewer outfalls. The receiving water model was modified to include an expression which would predict the extent and duration of the scour action from the submerged outfalls. Long term simulations of DO and other parameters were calibrated and verified using the response of the river to a multitude of rainfall events. The use of this model network in the evaluation of possible actions for abating combined sewer overflows produced magnitudes of DO and fecal coliform impacts for each action using 20 yrs of rainfall record. Cost-benefit analyses were performed for: existing conditions; partial separation; complete separation; out of basin (storage-conveyance-treatment); end of pipe; and 100% combined sewer outflow removal. (Brambley-SRC)
W81-02755

URBAN STORMWATER IMPACTS ON RECEIVING STREAMS IN NORTH CAROLINA,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
E. R. Brown, and R. S. Green.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-155426, Price codes: A99 in paper copy, A01 in microfiche.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, FL., Nov 26-28, 1979, EPA Report EPA 600/9-80-056, December, 1980. p 197-222, 11 Fig, 8 Tab, 15 Ref.

Descriptors: *Urban runoff, *Storm sewers, *Storm overflow sewers, *Stream degradation, *Stream biota, Water quality standards, Monitoring, Macroinvertebrates, Nutrients, Heavy metals, Aquatic animals, High flow, Suspended solids, Urban watersheds, Water pollution control, *North Carolina.

To determine the extent of water quality degradation in streams receiving urban stormwater runoff, selected streams were monitored in three of the larger urban areas within the state; Asheville, Raleigh, and Winston-Salem. The monitoring program involved physical/chemical sampling under both high (storm) and low streamflow conditions. Parameters sampled include pH, temperature, DO, five day BOD, COD, fecal coliform, ammonia-nitrogen, total Kjeldahl nitrogen, nitrite plus nitrate nitrogen, total phosphorus, iron, mercury, lead, zinc, copper, cadmium, chromium, nickel and solids. Biological sampling of aquatic benthic macroinvertebrates was conducted concurrently to further document water quality conditions. All of the urban streams exhibited extensive water quality problems. Physical/chemical sampling consistently revealed high pollutant concentrations for several parameters under high flow conditions. Notable problematic parameters included suspended solids, lead, and some nutrients. Several parameters were frequently present in high concentrations under low flow conditions also. Variations in pollutant concentrations from the different land use types were also observed. All of the urban streams monitored were found to be extensively biologically degraded. Populations of Diptera and Oligochaeta, pollution-tolerant organisms, averaged over 90% of the existing fauna. In contrast, control station population percentages of these organisms were a maximum of 15% of the fauna in the mountain stream, and 35% in Piedmont streams. Many intolerant groups were not just reduced in numbers in the urban streams; they were usually completely absent. Under present conditions, almost all urban streams will be unable to meet the 1983 water quality goals. Improvement of water quality conditions in these streams is dependent upon the development of programs to effectively manage the

entry of pollutants from urban land surfaces and unrecorded or intermittent point sources.
W81-02756

DISSOLVED OXYGEN IMPACT FROM URBAN STORM RUNOFF,
Sutron Corp., Arlington, VA.
T. N. Keefer, R. K. Simons, and R. S. McQuivey.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December 1980. p 223-244, 4 Fig, 2 Ref.

Descriptors: *Urban runoff, *Dissolved oxygen, *Storm runoff, *Water quality standards, Monitoring, Rainfall, Urban areas, Data processing, Water pollution sources, Statistical analysis.

Records from 104 water quality monitoring sites throughout the country were considered to determine whether a correlation exists between strength of dissolved oxygen (DO) deficit and the presence of rainfall and/or storm runoff in and downstream of urban areas. Daily data were obtained and processed for 83 of the sites. At 24 of the sites low DO correlated with flow, and at 18 sites with rainfall. This correlation was obtained by considering daily data for the entire water years, but did not occur every year. Oxygen levels of 5 mg/1 or less were not uncommon. Detailed hourly data analysis was made at 22 of the sites with high correlation between flow and DO deficit. Eleven of these would not meet a 5.0 mg/1 DO standard; six of the eleven would not meet the EPA-suggested standard of 2.0 mg/1 for 4 hr. The exact cause of the increase in DO deficit is not obvious in most cases. Violations of water quality standards appear to be infrequent. (Brambley-SRC)
W81-02757

THE IMPACT OF COMBINED SEWER OVERFLOWS ON THE DISSOLVED OXYGEN CONCENTRATION OF A SMALL STREAM,
Aalborg Univ., Denmark. Dept. of Environmental Engineering.
T. Hvitved-Jacobsen.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December, 1980. p 245-259, 9 Fig, 9 Ref.

Descriptors: *Combined sewer overflows, *Dissolved oxygen, *Water pollution, Stream pollution, Storm waste water, Water quality, Storm runoff, Biochemical oxygen demand, Benthos, Organic matter, *Denmark, Jutland, Skravad Brook.

Towns of 1,000-10,000 inhabitants often must discharge municipal waste water and stormwater to a small stream with a flow of 50-500 1/sec. During intensive storms, the flow may be increased several hundred percent. The discharged water from combined sewers may be a potential source for undesirable impact on the dissolved oxygen in the stream. The different oxygen consumption processes in receiving streams were studied at four stations in Skravad Brook in Jutland, Denmark, during and after the passage of storm overflows. Two different effects on the dissolved oxygen concentration were observed in the stream: an immediate effect, and a delayed effect. The immediate effect is caused by degradation of the soluble biochemical oxygen demand fraction in the water and by direct absorption of organic matter by bottom invertebrates. A delayed effect is caused by degradation of the adsorbed colloidal and settling particulate matter. The delayed degradation may increase the respiration of the bottom about 100%. This delayed effect may last 12-24 hours after the discharge event. The oxygen consumption of the organic matter input to the stream by a storm overflow is spread over a long period compared to time of passage of the polluted volume. This effect appears to be essential for evaluation and design of sewage systems within urban areas. (Moore-SRC)
W81-02758

IMPACTS OF INTERMITTENT URBAN DISCHARGES ON RECEIVING WATERS,
Manhattan Coll., Bronx, NY.
J. L. Mancini.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December, 1980. p 261-280, 8 Fig, 6 Tab, 6 Ref.

Descriptors: *Combined sewer overflows, *Water pollution, *Urban runoff, *Storm runoff, Beaches, Coliforms, Water quality, Water pollution control, Rainfall, Storm waste water, Stream flow, Toxicity, New York.

The impacts of combined sewer overflow discharges on bathing beach areas of New York City are investigated, and the treatment and costs for controlling water quality are defined. Calculated and observed time variable coliform distribution over several storm events are presented for the major water bodies that make up New York harbor. The results of the analysis indicate that discharges within 4 to 6 miles of the beach required control and treatment, while those further away from the areas to be protected had smaller effects on coliform levels at the beach, and treatment was not required to meet existing coliform standards. The cost of controls, even on this scale, are substantial and could represent 200 million dollars. One method for defining critical wet weather events has been identified and can be considered for use in developing frequency information which could provide a part of the basis for wet weather quality criteria. In its most generalized form the approach could consider hourly rainfall and stream flow records, variable runoff coefficients, and variable constituent concentrations as a function of rainfall intensity or volume. In the case of biological effects of instream concentrations of contaminants, it is necessary to consider the time of exposure in addition to the concentration of the contaminant. This is due to the transient nature of the intermittent loads from storm runoff events. (Moore-SRC)
W81-02759

THE RESPONSE OF GREAT LAKES ESTUARIES TO STORMWATER RUNOFF,
Corps of Engineers, Buffalo, NY. Buffalo District.
J. R. Adams, and S. M. Yaksich.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December 1980. p 281-300, 14 Fig, 2 Tab, 1 Ref.

Descriptors: *Storm runoff, *Storm water, *Water pollution, *River flow, Water quality, Water chemistry, Urban runoff, River mouth, Estuarine environment, Lake stages, Seasonal variation, Water pollution sources, *Great Lakes estuaries, Lake Erie, Maumee River.

Glacial rebound of the northern shore of Lake Erie has resulted in drowned rivermouths of southern shore tributaries. Transport of material through these estuaries depends not only on river stage but also lake stage. Three separate studies of water chemistry in the lower Maumee River were conducted during 1974 and 1975. Base flow river conditions and the resultant estuary chemical variations were measured during the summer of 1974, and winter storm runoff effects were measured during January and February 1975. Additional sampling and analysis were conducted during the summer of 1975, giving a fairly complete record of water chemistry variability. Winter storm runoff was also measured in the estuary of the Cuyahoga River, with simultaneous river and estuary sampling over the hydrograph for selected pollutants. This analysis demonstrates that the estuarine reach of the Maumee River is impacted by pollutants generated in the remainder of the basin, and that the water quality problems in the Toledo urban area are not solely the results of Toledo's own pollution of the river. Inputs of pollutants to the river during even moderately small summer storms can be considerably larger than inputs from Toledo. Impacts are increased by the fact that the entire volume of such summer storms does little more than replace a single volume of the estuarine volume. This polluted water often becomes stagnant in the estuary. In warm weather these events multiply to severely degrade the quality of water in the Maumee River. (Moore-SRC)
W81-02760

WATER QUALITY AND URBAN RUNOFF IN SELECTED CANAL COMMUNITIES ALONG THE TEXAS COAST,
Hays and Lindsey, Inc., Austin, TX.
A. L. Messenger, and T. D. Reynolds.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December, 1980. p 301-322, 9 Fig, 1 Tab, 10 Ref.

Descriptors: *Water quality, *Urban runoff, *Canals, *Rainfall, *Texas, Land development, Wastewater, Dissolved oxygen, Streeter-Phelps equations, Nutrients, Pesticides, Suspension, Sediments, Model studies, Storm runoff.

Water and runoff samples from seven waterfront communities in the Galveston Bay area were collected and analyzed in order to evaluate causes of canal water quality problems. Until present, community design has been based on optimum utilization of land area with little or no regard toward the effect of development on water quality. The primary cause of water quality problems in these communities appears to be urban runoff. Samples of canal waters were collected over a five-month period and analyzed for nutrients, oxygen demand, pesticides, and hydrological variables, including Rhodamine dye concentrations. In general, canal waters exerted BOD5 values of 2-10 mg/1 with no problems associated with toxic substances. Evaluation of domestic wastewater data from centralized treatment facilities indicates that these wastewater streams are not major sources of pollution loading. Runoff samples were collected from three rainfall-runoff events and were found to contain significant amounts of carbonaceous material. Also, the possibility of canal sediment resuspension by point discharge of runoff was investigated using a canal model. The two-year frequency rainfall event for the Galveston area was found to produce significant resuspension of high BOD5 benthic sediments. These data were applied using the modified Streeter-Phelps equations for estuarine dissolved oxygen analysis and were found to fit actual conditions with reasonable accuracy. (Authors' abstract)
W81-02761

THE RESPONSE OF SUBTIDAL INFAUNAL COMMUNITIES TO A CHANGE IN WASTEWATER DISCHARGE,
Washington Univ., Seattle. Coll. of Fisheries.
R. M. Thom, and K. K. Chew.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December, 1980. p 324-340, 8 Fig, 1 Tab, 16 Ref.

Descriptors: *Combined sewer overflows, *Storm waste water, *Water pollution, *Fauna, Waste water, Rainfall, Marine animals, Urban runoff, Invertebrates, Estuarine environment, Polychaetes, Crustaceans, Species diversity, Water depth, *Seattle, Washington, Puget Sound.

During rainy periods, sewage treatment plants in Seattle, Washington, become overloaded and some of the material in the sewers is released through combined sewer overflows (CSO). The CSO discharging the greatest volume of sewage into marine waters in Seattle is located at Denny Way in Elliot Bay, Puget Sound. The impact of this ephemeral source of raw waste water and street runoff on the macroinfaunal communities was evaluated using samples taken after periods of highest (April) and lowest (August) frequency of discharge. In April, the community nearest the overflow was characterized by a high number of indi-

viduals, a low number of taxa, a low species diversity, a high abundance of the polychaete Capitella capitata, and a high relative number of polychaetes. There was an area of markedly low infaunal abundance bordering the region of acute impact. Diversity and number of taxa were highest at the sites furthest from the overflow. The samples in August showed similar trends relative to the overflow in number of individuals, number of taxa, species diversity and community composition by species, phyla, and feeding type. Differences among all sites in these parameters were less pronounced during this period. A notable difference was the switch in numerical dominance to the leptostracan crustacean Nebalia pugettensis at the site nearest the overflow. A cluster analysis indicated that depth was of primary importance, and that the CSO was of secondary in producing among site differences. (Moore-SRC)
W81-02762

PRODUCTIVITY RESPONSES OF LAKE EOLA TO URBAN RUNOFF,
University of Central Florida, Orlando. Dept. of Civil Engineering and Environmental Science.
H. H. Harper, III, Y. A. Yousef, and M. P. Wanielista.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December, 1980. p 341-370, 7 Fig, 10 Tab, 13 Ref.

Descriptors: *Productivity, *Storm runoff, *Urban runoff, *Water pollution, *Eutrophication, Nutrients, Phosphorus, Dissolved oxygen, Nitrogen, Sediments, Heavy metals, Algal growth, Bioassay, Wastewater management, Lakes, Florida, *Lake Eola.

Lake Eola is a land-locked lake located in downtown Orlando, Florida. It is a focal point for the city and is visited by many tourists for its aesthetic appeal. From all indications, both visually and analytically, Lake Eola appears to be a lake in severe ecological distress. Persistent algal blooms exist virtually year round. Concentrations of dissolved oxygen, although usually at or above saturation near the surface drop periodically during the spring and summer months to less than 1 mg/l in deep areas of 4.0 m or more water column. Phosphorus from the bottom sediments was released up to a level of 250 mg/square m after two months of anoxic conditions. Bioassay experiments were utilized to study the impact of stormwater runoff, untreated and coagulated on productivity of Lake Eola water. It is concluded that management of stormwater runoff is essential if restoration of Lake Eola is to be successful. Considerable amounts of nutrients are released by stormwater runoff. Phosphorus is probably the most important nutrient in regulation algal production in Lake Eola. From bioassay experimentation, stormwater up to 25% mixture with lake water will enhance algal productivity. A mixture of lake water and dry weather flow from storm drains did not produce changes in algal production. If stormwater runoff is coagulated with alum before its release to the lake, no significant increase in algal production will be produced. Stormwater contains heavy metals and organic compounds which may be in concentrations toxic to algal species in lake water. (Moore-SRC)
W81-02763

WATER QUALITY AND BIOLOGICAL DEGRADATION IN AN URBAN CREEK,
Woodward Clyde Consultants, San Francisco, CA.
R. Pitt, and M. Bozeman.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December, 1980. p 371-405, 5 Fig, 19 Tab, 14 Ref.

Descriptors: *Urban runoff, *Water pollution, *Aquatic animals, *Storm runoff, *Water pollution sources, Heavy metals, Nutrients, Nitrogen, Lead, Feces, Fertilizers, *California, Coyote Creek, San Jose.

Coyote Creek, near San Jose, California is being studied to determine the effects of urban runoff on water quality and biological organisms in the creek. Most of the urban runoff pollutants are soluble, and can be carried in the water columns of receiving waters. Almost all (95%) of the lead compounds present in urban runoff are expected to be insoluble particulates. Non-urban stations are affected by runoff from undeveloped and agricultural areas, and urban stations are affected by runoff from those areas as well as the runoff from urban areas. Urban runoff pollutant sources include: lawn and landscaped areas, vacant lots, rooftops, sidewalks, parking lots, and street surfaces. Vacant land and landscaped areas are among the most pervious surfaces in urban areas and are located farthest from urban drainage systems, therefore they contribute only a small fraction of the pollutants. Street surfaces are located very close to the storm drainage system and are almost impervious. They comprise about 15-20% of the study area, and most of the runoff is expected to reach the outfall. Automobile activity is responsible for most of the heavy metal yield in the runoff and about half of the total solids yield. Vegetation sources contribute most of the oxygen-demanding materials, while animal feces and fertilizers are thought to contribute most of the nitrogen in urban runoff. Preliminary biological investigations in Coyote Creek have indicated distinct differences in the taxonomic composition and relative abundance of the aquatic biota present in various reaches of the stream. The non-urban sections of the creek support a comparatively diverse assemblage, including 12 species of fish, and various benthic macroinvertebrates. The urban portions comprise an aquatic community that is generally lacking in diversity and is dominated by pollution-tolerant organisms. (Moore-SRC)
W81-02764

NATIONWIDE ASSESSMENT OF URBAN STORMWATER POLLUTION IMPACTS ON RECEIVING WATER BODIES,
Florida Univ., Gainesville.
J. P. Heaney, W. C. Huber, and M. E. Lehman.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December, 1980. p 407-436, 2 Fig, 5 Tab, 18 Ref.

Descriptors: *Urban runoff, *Storm runoff, *Water pollution, *Literature review, Fishkill, Water quality, Beaches, Environmental effects, Storm water, Water pollution sources.

The projected costs for abating urban stormwater pollution through elimination or reduction of discharges range in the billions of dollars. This has forced a look beyond abatement of discharges to the receiving water bodies for insights as to what are the impacts, where are they, and are they significant. A study was undertaken to inventory documented receiving water impacts from urban runoff on a nationwide basis. The search for documentation included published and unpublished literature, Section 201 and Section 208 projects (PL92-500), EPA-furnished project materials, EPA fish kill data files, National Urban Runoff Program Proposals, and miscellaneous water quality reports and permit files. Impacts due to stormwater runoff can be defined at three levels: policy or master plan violations; criteria or standards violations; and actual environmental degradation or loss of beneficial use, such as fish kills and beach closings. Findings to date indicate that documented case studies of impacts of urban runoff on receiving waters are scarce. Most cases of documented impacts were made for minor receiving water bodies. Large water bodies tended to have sufficient dilution, adequate flushing or multiple source imputs which obscure impact differentiation. The significance of stormwater impacts on receiving water bodies cannot be assessed at this time. The sparseness of documented cases, the lack of detailed data, and the general focus of stormwater investigations do not provide a substantial basis for determinations. (Moore-SRC)
W81-02765

STATISTICS OF RECEIVING WATER RESPONSE TO RUNOFF,
Manhattan Coll., Bronx, NY. Environmental Engineering and Science Program.
D. M. DiToro.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December 1980. p 437-465, 10 Fig, 1 Tab, 12 Ref, 1 Append.

Descriptors: *Runoff, *Storm runoff, *Water pollution, *Statistical methods, Combined sewer overflows, Storm waste water, Mathematical models, Mathematical studies, Rainfall, Dissolved oxygen, Biochemical oxygen demand.

The analysis of receiving water responses to intermittent discharges from separate and combined sewer overflows is a problem of substantial difficulty. The problem setting is inherently time variable due to the transient mass discharges, and although a time variable integration of the mass balance equations describing the receiving water response is possible, it is an unwieldy and laborious undertaking. An analysis is presented for the mean and variance of a one dimensional advective dispersive system that is subjected to random inputs of runoff. Analytical solutions are available for which the mass input is represented as a Poisson process of delta functions. The effects of event to event variability of runoff mass discharges are included in the formulation as are the random times between overflows. The method of solution evaluates the overlapping effects in the receiving water due to the persistence of discharged mass. Both conservative, first order reactants, and sequentially reacting substances are considered. The solutions have certain unexpected properties. In particular, the normalized variance of biological oxygen demand and dissolved oxygen are symmetric about the discharge point, whereas the means of the concentration are not. This is explained in terms of the effects of advection and dispersion of fluctuations. The analytical solutions are compared to simulated results using an observed hourly rainfall sequence. The results indicate that the within event variability is not significant, if the receiving water dispersion is large enough. It is also pointed out that treatment devices such as retention basins which remove a certain average fraction of the overflowing mass are less effective in removing variance in the receiving water. This phenomenon is of importance in the evaluation of the probable benefit of runoff treatment. (Moore-SRC)
W81-02766

CONTINUOUS RECEIVING WATER QUALITY MODELING FOR URBAN STORMWATER MANAGEMENT,
Duke Univ., Durham, NC. Dept. of Civil Engineering.
M. A. Medina, Jr.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December, 1980. p 466-501, 9 Fig, 2 Tab, 18 Ref, 2 Append, R-802411.

Descriptors: *Urban runoff, *Waste water treatment, *Storm waste water, *Water pollution, *Mathematical models, Model studies, Water quality, Dissolved oxygen, Storm runoff, Rainfall, Iowa, Des Moines River.

A simplified continuous receiving water quality model has been developed as a planning guide to permit preliminary screening of areawide waste water treatment strategies. The model simulates the hypothetical response of the stream or tidal river system to the separate and combined effects of waste inputs from: (1) upstream sources, (2) dry weather urban sources, and (3) wet weather urban sources. The total hours of runoff-producing rainfall throughout a year are separated into storm events by defining a minimum inter-event time. For a given storm event, the runoff and pollutant loads are summed and critical dissolved oxygen concentrations are estimated as a function of sever-

al hydrodynamic and biochemical parameters. Alternative control strategies are evaluated in terms of relative impacts by determining the probability of occurrence of water quality violations. Model output includes the downstream dissolved oxygen sag curves computed per each event, and the dissolved oxygen profile computed at a user-specified location downstream for all simulated events. An application to the Des Moines River at Des Moines, Iowa, is presented. (Author's abstract)
W81-02767

POTENTIAL OF URBAN STORMWATER IMPACTS BASED ON COMPARATIVE ANALYSIS OF WET AND DRY WEATHER POLLUTANT LOADS,
Municipal Environmental Research Lab., Edison, NJ. Storm and Combined Sewer Section.
D. Ammon, and R. Field.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December 1980. p 502-522, 5 Fig, 14 Tab, 32 Ref.

Descriptors: *Urban runoff, *Storm runoff, *Combined sewer overflows, *Water pollution, Storm waste water, Heavy metals, Biochemical oxygen demand, Chemical oxygen demand, Hydrocarbons.

Urban stormwater discharges and combined sewer overflows are significant contributors of many pollutants to receiving waters. Summaries of urban wet-weather characterization data are presented for several groups of parameters including heavy metals, petroleum hydrocarbons, biochemical oxygen demand (BOD) and chemical oxygen demand. Comparisons are presented between the pollutant loads from urban wet-weather discharges and from publicly owned treatment works effluents to indicate the relative importance of each source. Combined sewer overflows are calculated to contribute about 380 lb/acre/yr of BOD, which is about 28% of the annual load from the combined sewered area with no treatment of the dry-weather flow. In separate sewered areas, urban stormwater discharges contribute about 70 lb/acre/yr of BOD, which is about 45% of the annual BOD load if secondary treatment is provided for the dry-weather flow. The relative magnitudes of urban wet-weather loads compared to the publicly owned treatment works discharges are much greater during and following storm events. Several heavy metals occur in sufficient concentrations in urban stormwater discharges and combined sewer overflows to exceed quality criteria even with many dilutions. Load comparisons show that urban wet-weather discharges contribute more of several metals, such as cadmium, chromium and lead, to receiving waters than treatment works effluents. Urban stormwater and combined sewer overflows contribute significant portions of oil and grease, and petroleum hydrocarbons to the environment. (Moore-SRC)
W81-02768

THE USE OF RECEIVING WATER QUALITY MODELS IN URBAN RUNOFF POLLUTION ABATEMENT: APPLICATION TO MARGINAL BENEFIT - MARGINAL COST ANALYSIS,
O'Brien and Gere Engineers, Inc., Syracuse, NY.
C. B. Murphy, Jr., G. J. Welter, D. A. MacArthur, and R. P. Canale.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December, 1980. p 524-556, 16 Fig, 2 Tab, 4 Ref.

Descriptors: *Urban runoff, *Water pollution, *Model studies, *Cost-benefit analysis, Water quality, Storm waste water, Storm runoff, Combined sewers, Water pollution control, Combined sewer overflows, Hydrological regime, Temperature.

Urban storm runoff has been determined by a number of investigators to represent a significant portion of the water pollution problem and abatement of this source has been recognized as a necessary consideration in achieving the national water quality goals. However, due to the highly irregular nature of the runoff phenomenon abatement measures that address this problem tend to be expensive and difficult to size. Using ongoing studies of combined sewer systems in Rochester, New York and Washington, D. C., as case studies, a procedure is presented for the application of receiving water analyses in urban runoff planning. The studies in both areas have included the development of water quality models based on familiar concepts of mass balance and calibrated against detailed field surveys and laboratory experiments. In an analysis of marginal costs and marginal benefits associated with various combined sewer overflow abatement alternatives, a series of model runs are made to project the impact of various waste discharges from the alternate system configurations on the receiving waters under several hydrologic regimes and ambient temperatures. The conjoint probabilities of the receiving water conditions and storm loads are determined on the basis of historical records and used to project the expected water quality under the alternative system configurations. These projections can be quantified as water quality improvements in terms of expected degree of contravention of stream standards with regards to frequency, duration, areal extent and peak concentration. On the basis of this analysis of project cost estimates drawn from generalized cost curves, marginal costs and benefits can be displayed graphically for each alternative. (Moore-SRC)
W81-02769

METHODOLOGY FOR EVALUATING THE IMPACT AND ABATEMENT OF COMBINED SEWER OVERFLOWS, A CASE STUDY OF ONONDAGA LAKE, NEW YORK,
Stearns and Wheler, Cazenovia, NY.
P. E. Moffa, J. C. Byron, S. D. Freedman, J. M. Karanik, and R. Ott.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December, 1980. p 557-589, 14 Fig, 3 Tab, 18 Ref. R805096010.

Descriptors: *Combined sewer overflows, *Storm runoff, *Water pollution, *Mathematical models, Model studies, Urban runoff, Dissolved oxygen, Phosphorus, Computer models, Recreation, Coliforms, Rainfall, Cost analysis.

A general methodology is presented for the evaluation of the impact and abatement of combined sewer overflows on receiving waters. It was developed from experience with Onondaga Lake in Central New York which receives combined sewer overflows from the City of Syracuse. Field investigations of the combined sewer system and the receiving water must first be undertaken. Use of a computerized data bank has been found virtually essential for the storage and manipulation of the large quantity of data resulting from the sampling and analysis. Mathematical modeling of the receiving water is undertaken to evaluate water quality as a function of pollutant load; the storm sewer system is modeled to determine the quantities of pollutants discharged during various storm conditions. Abatement alternatives and their respective costs are investigated for the reduction of pollutants from wet-weather sources, particularly combined sewer overflows. From the models it was determined that the impact of combined sewer overflows on dissolved oxygen concentrations in Onondaga Lake will not be critical after tertiary treatment for dry-weather waste water are placed in operation. Combined sewer overflow contributions of phosphorus will be negligible in comparison to those from other sources. In an average rainfall year, 38 violations of the fecal coliform standard will occur in the area of the lake intended for contact recreation. If abatement of pollution were to follow the 'general optimum solution' of this methodology, there would still be 13 annual violations. (Moore-SRC)
W81-02770

ENVIRONMENTAL EFFECTS OF WESTERN COAL SURFACE MINING, PART VI - SMALLMOUTH BASS AND LARGEMOUTH BASS IN THE TONGUE RIVER RESERVOIR, MONTANA, 1975-76,
Montana Cooperative Fishery Research Unit, Bozeman.
R. F. Penkal, and R. W. Gregory.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-194319, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-045, May, 2720. 54 p, 6 Fig, 14 Tab, 47 Ref. R803950.

Descriptors: *Fish populations, *Bass, *Coal mining, Strip mines, *Environmental effects, Reservoirs, Turbidity, Mortality, Growth, Water pollution sources, *Mine wastes.

Population parameters of smallmouth bass (Micropterus dolomieui) and largemouth bass (M. salmoides) were studied during 1975 and 1976, before expansion of surface coal mining adjacent to the Tongue River Reservoir in southeastern Montana. Reproductive success, as determined by alongshore seining, varied in different areas of the reservoir and may be correlated to turbidity. Population estimates were obtained at night during spring and fall 1976 with boat electrofishing gear. For yearling and older smallmouth bass the fall population of 13.0 fish/ha and the standing crop of 2.03 kg/ha represented 80 and 84% of the totals for basses in the reservoir. The largemouth bass population and standing crop during fall 1976 was 3.2 fish/ha and 0.32 kg/ha. The dominance by smallmouth bass of all year classes for both species except age-1, was attributed to a much higher mortality of underyearlings among largemouth bass. This higher mortality of largemouth bass may be correlated to a lack of shoreline vegetation in the reservoir. Summer mortality of age-2 and older smallmouth bass, estimated from the reduction in numbers of marked fish, was about 40%. Smallmouth bass growth and condition were better in the upper than lower end of the reservoir; the difference may be due to forage fish availability. Growth and length-weight relationships were above average for both species when compared with basses in other northern waters, indicating no noticeable effect from nearby surface coal mine operations at the time of the study. (Author's abstract)
W81-02775

WASTE DISCHARGE REQUIREMENTS FOR NONSEWERABLE WASTE DISPOSAL TO LAND,
California State Water Resources Control Board, Sacramento.
A. L. Franks.
Report, July 1980. 93 p, Append.

Descriptors: *California, *Waste disposal, *Waste dumps, *Groundwater pollution, Landfills, Land disposal, Groundwater contamination, Leachates, Industrial wastes, Solid wastes, Farm wastes, Animal wastes, Sludge disposal, Infiltration.

This document, developed to describe portions of the California Administrative Code regarding waste disposal to land, indicates general guidelines and minimum standards for such disposal. However, due to specialized local conditions, Regional Boards may establish more stringent standards on a waste disposal operation or a site closure. The report contains a summary of relationships between solid wastes and water quality, the disposal site classification system, examples of waste discharge requirements, closure requirements, and a discussion of selected sections of the Code regarding waste disposal to land. There is also a discussion of the parameters that are considered in formulating waste discharge requirements, developing closure requirements, providing for financial responsibility for waste disposal sites, and the administration of the State Site Closure and Maintainance Revolving Account. Not included, but to be developed at a later date, are guidelines to determine the acceptability of a report on assurances that monies are available, in the amount estimated, as called for in Section 2557 of the Code. (Garrison-Omniplan)
W81-02798

KELP BEDS AT SAUNDERS REEF, MENDOCINO COUNTY.
California State Water Resources Control Board, Sacramento.
California Marine Waters, Areas of Special Biological Significance, Reconnaissance Survey Report. Water Quality Monitoring Report No 80-3, September 1980. 42 p, 3 Fig, 5 Tab, 20 Ref.

Descriptors: *California, Marine resources, *Kelps, *Reefs, *Marine biology, Marine geology, *Coastal waters, Marine plants, Biological oceanography, Environmental protection, Wastewater outfall, On-site data collections, Saunders Reef, Mendocino County.

The kelp beds at Saunders Bay in northern California are designated by the California State Water Resources Control Board as an Area of Special Biological Significance (ASBS). It is a complex area bounded on the east by cliffs supporting a characteristic maritime bluff flora. To evaluate the status of protection of the marine resources of this ASBS, a reconnaissance survey was performed. The study concluded that (1) activity around and west of Highway 1 should be carefully planned to avoid increased erosion, view alteration and possible wastewater escape into the ASBS; (2) increased public access will impact the relatively pristine condition of the ASBS; (3) future impact studies should include long-term studies of the impacted communities with field experiments to test any effects of perturbations. Lack of access, rough sea conditions, and the presence of red abalone all suggest that the area has not been greatly affected thus far by man's activities; this may change with increased use by skin divers and greater coastal access. Some of the surrounding land is subdivided for home construction, and development could increase bluff erosion and restrict the view of the reef. The use of home septic tank systems has the potential of allowing polluted water into the ASBS. (Garrison-Omniplan)
W81-02799

SAN DIEGO MARINE LIFE REFUGE, SAN DIEGO COUNTY.
California State Water Resources Control Board, Sacramento.
California Marine Waters, Areas of Special Biological Significance, Reconnaissance Survey Report. Water Quality Monitoring Report No 80-5, September, 1980, 52 p, 1 Fig, 5 Tab, 24 Ref, 4 Append.

Descriptors: *California, Marine resources, *Marine biology, *Coastal waters, Marine geology, Marine plants, Biological oceanography, Environmental protection, Wastewater outfall, Wastewater pollution, Storm wastewater, On-site data collections, *San Diego Marine Life Refuge.

Areas of Special Biological Significance (ASBS) have been designated by the California State Water Resources Control Board in its effort to adopt water quality control plans for wastes discharged to ocean waters. To evaluate the protection status of marine resources at San Diego Marine Life Refuge, an ASBS, a reconnaissance survey was conducted that integrated all available hydrographic, geologic and biological information. Means of investigation included a search of records, map reconnaissance, shoreline and underwater observations, interviews, and a literature review. There appeared to be no actual point source pollution threats except that of sewage spills during periods of heavy rainfall. Sailing, shore fishing, snorkeling, SCUBA diving, surfing, body surfing, and tide-pooling are some of the water-use recreational activities that occur within the Refuge, which is adjacent to Scripps Institute of Oceanography in La Jolla. The study suggested periodic but regular monitoring of the ASBS to evaluate accurately the status of protection afforded the area. The study also urges consideration be given to extending the boundaries of the Refuge to include the head of Scripps Canyon. (Garrison-Omniplan)
W81-02800

JULIA PFEIFFER BURNS UNDERWATER PARK, MONTEREY COUNTY.
California State Water Resources Control Board, Sacramento.
California Marine Waters, Areas of Special Biological Significance, Reconnaissance Survey Report. Water Quality Monitoring Report No 80-4, September, 1980. 76 p, 11 Fig, 9 Tab, 33 Ref, 2 Append.

Descriptors: *California, Marine resources, *Marine biology, *Waste water outfall, Marine geology, *Marine fisheries, Submarine canyons, Submerged plants, Biological oceanography, Coastal waters, Environmental protection, Contamination, Waste water pollution, Storm waste water, On-site data collections, *Julia Pfeiffer Burns Underwater Park.

Diverse and abundant assemblages of sessile, filter-feeding invertebrates make the Julia Pfeiffer Burns Underwater Park one of the most beautiful locations on the California coast. This area was designated an Area of Special Biological Significance (ASBS) by the California State Water Resources Control Board in the adoption of water quality control plans for wastes discharged to ocean waters. Subtidal regions were surveyed using SCUBA to note topography, habitats, and macroorganisms; other data were collected using photography and landside observations. Because of the ASBS's poor access from land and sea, and its distance from Monterey, no threats to water quality were found. However, some impacts are possible in the future because nearby parks allow hiking and picnicking, and commercial fishing is allowed within the boundaries of the ASBS to a depth as shallow as 325 feet. Sportfishing is limited by the lack of accessibility. Although the ASBS is within Kelp Lease Area 214, no harvesting of giant kelp takes place. The ASBS is contained within the California State Sea Otter Reserve. There are many kinds of biota found in the underwater park that are listed in the report. For safety reasons, the study recommends that recreational diving not be permitted. (Garrison-Omniplan)
W81-02801

INTERACTIONS OF LIGHT AND NITROGEN SOURCE AMONG PLANKTONIC BLUE-GREEN ALGAE,
Alabama Univ., University. Dept. of Biology.
A. K. Ward, and R. G. Wetzel.
Archiv fur Hydrobiologie, Vol 90, No 1, p 1-25, September, 1980. 12 Fig, 4 Tab, 44 Ref.

Descriptors: *Plankton, *Cyanophyta, *Light penetration, *Nitrogen fixation, Eutrophication, Nutrients, Aquatic algae, Biomass, Aquatic life, Aquatic microorganisms.

Studies were conducted to describe the light regime, possible nitrogen sources and genera of blue-green algae associated with nitrogen-fixing, epilimnetic blue-green algae and non-nitrogen-fixing metalimnetic blue-green algae, to evaluate growth rates of representative isolates of blue-green algae on different nitrogen sources under light regimes similar to those found in natural populations, and to evaluate short-term responses to changes in light intensity in relation to photosynthetic rates and changes in carbon and nitrogen content with various nitrogen sources. Two different aquatic systems were studied, one the moderately productive Lawrence Lake and the other the hypereutrophic Wintergreen Lake. The findings suggested that the nitrogen source determined the lowest light intensity necessary to maintain growth in these aquatic systems. Most of the carbon and nitrogen fixation occurred within an array of light intensities ranging from very low to high, but significantly less than surface values. Based on saturation curves and lake profiles of nitrogen and carbon fixation in this study, the range of light intensities should result in a more balanced C:N ratio than continuous exposure to surface values or very low light intensities. Additionally it would provide sufficient photogenerated reductant and carbon reserve for maintenance of carbon and nitrogen fixation. Spatial optimization with regard to light and nitrogen source among planktonic blue-green algae is suggested by the findings of this study. (Baker-FRC)
W81-02807

POLLUTION OF SEA WATER AND MARINE SEDIMENTS IN COASTAL AREAS,
Orleans Univ. (France).
For primary bibliographic entry see Field 5B.
W81-02808

THERMAL TOLERANCE OF THE ISOPOD LIRCEUS BRACHYURUS (CRUSTACEA:ISOPODA),
Tennessee Univ., Knoxville. Dept. of Zoology.
N. J. Cheper.
American Midland Naturalist, Vol 104, No 2, p 312-318, October, 1980. 1 Fig, 1 Tab, 18 Ref.

Descriptors: *Lirceus brachyurus, *Invertebrates, *Isopods, *Thermal stress, Thermal pollution, Aquatic life, Aquatic animals, Water pollution effects, Temperature, Water temperature, Heated water, Hydroelectric plants.

The temperature tolerance of a freshwater macroinvertebrate, the isopod Lirceus brachyurus (Crustacea:Isopoda) was investigated. Isopods were collected between August 1977 and July 1978 from a small tributary of Buffalo Creek in Anderson County, Tennessee. For each tolerance test, 12 animals were immediately exposed to the test temperature and 12 were gradually exposed to the test temperature. Animals were checked for mortality at 1/2, 1, 2, 4 and 8 hr after exposure had begun. Subsequent examinations were made every 8 hr for 2 wk. Only at the highest temperature, 35C, did the manner of exposure, gradual vs immediate, make a difference in the adaptability of the test animals. At this temperature, animals exposed gradually succumbed less rapidly. However, once this temperature was reached, there was no difference in rate of death. Animals acclimated at 25C showed high natural mortality rates (60%) during acclimation. The highest temperature tolerated by the species exceeded that to which the animal would be exposed under natural conditions, thus forming a safety margin. The results indicate that Lirceus brachyurus populations would be severely affected by hot water discharges, while cold water discharges during initiation of power plant output or after periods of plant shutdown would not affect isopod populations. (Baker-FRC)
W81-02810

INCIDENCE OF PLASMIDS IN MARINE VIBRIO SPP. ISOLATED FROM AN OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO,
Houston Univ., TX.
For primary bibliographic entry see Field 5A.
W81-02813

MEASUREMENT OF PHYSIOLOGICAL CONDITION OF MUSSELS TRANSPLANTED ALONG A POLLUTION GRADIENT IN NARRAGANSETT BAY,
Environmental Research Lab., Narragansett, RI.
J. Widdows, D. K. Phelps, and W. Galloway.
Marine Environmental Research, Vol 4, No 3, p 181-194, 1980-1981. 2 Fig, 4 Tab, 34 Ref.

Descriptors: *Mussels, *Narragansett Bay, *Bioindicators, Animal physiology, *Water pollution effects, Pollutant identification, Organic compounds, Metals, Environmental effects, Sediments, Growth rates, Oil pollution, Oxygen requirements, Metabolism, Rhode Island.

Mussels transplanted to 4 sites along a pollution gradient in Narragansett Bay declined in performance and physiological condition from south to north, corresponding with increasing water pollution. Hydrocarbons in surface sediments increased from 0.11 mg per g at the relatively unpolluted southernmost site to 2.04 mg per g dry weight at the most polluted northern site. Metals (Cd, Cr, Cu, Ni, Pb, and Zn) showed a similar increase. Oxygen consumption at the stations did not vary significantly. Clearance rates declined from 5.21 liters per hour at the least polluted station to 2.54 liters per hour at the most polluted station in August, 5.91 liters per hour to 3.19 liters per hour in October. Ammonia excretion was highest at the most polluted site. The O:N ratio declined from 75

in the north to 29.6 in the south in August, but was not statistically different in October. An O:N ratio of 30 or less indicates a very stressed condition. Scope for growth declined from 35.64 Joules per hour (south) to 7.17 J per hour (north) in August and 28.90 (south) - 7.25 (north) J per hour in October. (Cassar-FRC)
W81-02819

IMPACT OF A COMBINED SEWER OVERFLOW ON THE ABUNDANCE, DISTRIBUTION, AND COMMUNITY STRUCTURE OF SUBTIDAL BENTHOS,
Washington Univ., Seattle. Coll. of Fisheries.
J. W. Armstrong, R. M. Thom, and K. K. Chew.
Marine Environmental Research, Vol 4, No 1, p 3-23, 1980-81. 9 Fig, 4 Tab, 41 Ref.

Descriptors: *Benthic fauna, *Invertebrates, *Sewage effluents, Intertidal areas, Organic matter, Combined sewers, Path of pollutants, Water pollution effects, Benthos, Marine animals, Biological communities, *Puget Sound, Seattle, Washington, Municipal wastes, Waste water treatment, Polychaetes, Mollusks, Sediments, Heavy metals, Metals, *Combined sewer overflows.

Seattle, Washington, discharges its combined stormwater and sanitary wastes into an intertidal area of Puget Sound. During rain storms, capacities of the treatment plants are exceeded, releasing untreated domestic and industrial wastes into the marine environment. The effect of these pollutants on marine invertebrates was determined during a study conducted during April and May, 1977. Fauna close to and southwest of the outfall were most acutely affected. Opportunistic species, the polychaete Capitella capitata and the amphipod Aoroides columbiae, favored the most polluted sites, where zinc, copper, and lead were present in the sediment and volatile organic matter was plentiful. Burrowing deposit feeders were common. At sites further from the outflow, mollusks and crustaceans, especially the bivalve Axinopsida serricata, became more abundant. Surface feeding organisms also were more plentiful. Shallow subtidal areas (9 m below MLLW) appeared more affected by the pollution than deeper sites (13 and 24 m below MLLW). (Cassar-FRC)
W81-02820

SEDIMENT CHARACTERISTICS OF ELEOCHARIS ACICULARIS (L.) R. S. SITES IN STREAMS AND LAKES OF CENTRAL PENNSYLVANIA,
Pennsylvania State Univ., University Park. Dept. of Botany.
G. C. Kroh, and R. D. Schein.
Journal of Environmental Quality, Vol 10, No 1, p 49-52, January-March, 1981. 1 Fig, 2 Tab, 20 Ref.

Descriptors: *Acid mine water, *Water pollution effects, *Rooted aquatic plants, Acid streams, Mine drainage, Mine wastes, Sediments, Nutrients, Absorption, Aquatic productivity, *Pennsylvania, Acidity, Phosphorus, Soil chemistry.

Many streams of Central Pennsylvania have been polluted by acid mine drainage from coal mining activities. These streams are clear, unproductive, and contain few plankton and no fish. In order to restore aquatic communities to these waters, the macrophyte Eleocharis acicularis (L.) R. and S. (slender spikerush) was examined for its ability to grow on stream sediments. Radioactively labeled phosphorus was absorbed by the roots of the slender spikerush and transported to the leaves. Analyses of sediments from 14 different locations where the plant was growing showed that these macrophytes were generalists which could survive a large variety of chemical parameters provided that the predominant sediment make up was a silt-clay. The plants were very acid tolerant and provided a structural niche for periphyton and invertebrate consumers. The slender spikerush was also able to stabilize and modify the alluvial sediment with its filamentous root system and was considered an important factor in the restoration of mine-acid polluted streams. (Geiger-FRC)
W81-02821

THE EFFECT OF GLUCOSE ON THE PRODUCTIVITY OF SEAWATER: AN EXPERIMENTAL APPROACH USING CONTROLLED AQUATIC ECOSYSTEMS,
British Columbia Univ., Vancouver. Dept. of Oceanography.
T. R. Parsons, L. J. Albright, F. Whitney, C. S. Wong, and P. J. Le B. Williams.
Marine Environmental Research, Vol 4, No 3, p 229-242, 1980-1981. 9 Fig, 3 Tab, 19 Ref.

Descriptors: *Productivity, *Sea water, *Carbohydrates, Organic matter, Bacteria, Nutrients, Phytoplankton, Algae, Marine algae, Nitrates, *Glucose, Water pollution effects, Photosynthesis, *Ecosystems.

Glucose was added in small quantities (1 or 5 mg per liter) to 60-ton enclosed sea water columns to study the effect of organic loading in marine waters. Additions of glucose and nutrients were made every three or four days over a 28-day period to two enclosures, with only nutrients in the control. Glucose enrichment caused an increase in the heterotrophic bacterial biomass and a decrease in algal production. Nitrate was a limiting factor, bacteria succeeding in competition with the phytoplankton. Secondary and tertiary productivity in the two heterotrophic systems were higher than in the autotrophic control. (Cassar-FRC)
W81-02825

GROWTH RESPONSES OF YELLOW PERCH, PERCA FLAVESCENS (MITCHILL), TO LAKE ACIDIFICATION IN THE LA CLOCHE MOUNTAIN LAKES OF ONTARIO,
Toronto Univ. (Ontario). Dept. of Zoology.
P. M. Ryan, and H. H. Harvey.
Environmental Biology of Fishes, Vol 5, No 2, p 97-108, April, 1980. 6 Fig, 2 Tab, 32 Ref.

Descriptors: *Perch, *Lakes, *Acidic water, Bioindicators, Growth rates, Freshwater fish, Yellow perch, La Cloche Mountains, *Ontario, Fish reproduction, Fish populations, Stress, Water pollution effects, Hydrogen ion concentration, Size, Environmental effects.

The effects of acid waters on growth of yellow perch were studied from 1966 to 1974 in 38 lakes in the La Cloche Mountains of Ontario. Fish 1 to 3 years old grew more rapidly; fish 4 to 9 years old had reduced growth rates. The relationship of mean length at a given age to lake pH (which varied from 4.10 to 6.48) was best described by linear equations. The increased growth rates of 1 to 3 year fish can be attributed to increases in food supply caused by a decrease in competition from less tolerant species. The most acid lakes contained very few fish 0 to 2 years old. Older perch, 4 to 9, showed reduced growth rates, possibly from acid stress, which can cause severe osmotic disturbances. Fish respond to this by expending energy at the expense of growth. Food species are also fewer. The growth rate of yellow perch may be useful as an indicator of environmental stress. (Cassar-FRC)
W81-02833

CHANGES IN NITROGEN CYCLING AT AN OLD-GROWTH DOUGLAS-FIR SITE AFTER DISTURBANCE,
Oregon State Univ., Corvallis. Dept. of Forest Science.
P. Sollins, K. Cromack, Jr., F. M. McCorison, R. H. Waring, and R. D. Harr.
Journal of Environmental Quality, Vol 10, No 1, p 37-42, January-March, 1981. 3 Fig, 2 Tab, 40 Ref.

Descriptors: *Nitrate, *Soil water, *Water quality control, Nitrogen, Cycling nutrients, Herbicides, Nitrification, Soil water movement, Foliar, Forest management, Seasonal, Ammonia, Leaching, Coniferous forests, *Forest watersheds.

The exportation of dissolved N from terrestrial ecosystems through soil water can affect N availability for productivity as well as the processes in natural streams and water quality. The effects of disturbances on the N cycle were examined in a 450-year-old Douglas-fir stand on a 10.24-ha watershed of the H. J. Andrews Experimental Forest in Oregon. All vegetation was killed by herbicides while causing as little disturbance as possible to the leaf litter and soil. Foliage samples collected in July and August of 1974 were analyzed for N, lignin, and cellulose. The concentration of nitrogen in falling foliage and the soil moisture were greater on the herbicide treated plot than in the control area. Soil solution levels of nitrate and Kjeldahl N were higher on the treated than on the untreated sites at depths greater than or equal to 1 meter or at the bottom of the rooting zone. On the undisturbed plots, nitrate was found in solution at significant levels only at a depth of 2 meters. These findings suggest that studies on the impact of forest management practices or other disturbances on N budgets and water quality should consider measurements of total N transfers, and not only transfers of nitrate N. (Geiger-FRC)
W81-02844

COAL-LIQUEFACTION PRODUCTS, SHALE OIL, AND PETROLEUM. ACUTE TOXICITY TO FRESHWATER ALGAE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
J. M. Giddings, and J. N. Washington.
Environmental Science and Technology, Vol 15, No 1, p 106-108, January, 1981. 2 Tab, 31 Ref.

Descriptors: *Oil pollution, *Water pollution effects, *Algae, Fuels, Toxicity, Synthetic fuels, Oil spills, Aquatic life, Aquatic algae, Aquatic plants, Coal liquefaction industry, Shale oil industry, Cyanophyta.

Freshwater algae, Selenastrum capricornutum (a green alga) and Microcystis aeruginosa (a blue-green alga), showed acute toxic effects from exposure to water soluble fractions (WSF) of oils in the following order: coal liquefaction products>shale oil products>petroleum products. WSF's were tested in concentrations of 0.1, 1, 10, and 100%. Most of the 11 coal liquefaction products were toxic at 1% and greater; 4 at 0.1%. Three unrefined shale oils inhibited photosynthesis at 10% and greater and were variably toxic at 1% and less. Two refined shale oils and the 5 petroleum products (DFM, No 2 diesel oil, and three No 6 fuel oils) showed little toxicity at all concentrations with the exception of some at 100% WSF. All samples were tested for absorbance at 254 nm, the absorption maximum for benzene and an approximation of aromatic content. The products with higher absorbances tended to be the most toxic to algae. (Cassar-FRC)
W81-02854

THE INADEQUACY OF EXISTING CHLOROPHYLL-A/PHOSPHORUS CONCENTRATION CORRELATIONS FOR ASSESSING REMEDIAL MEASURES FOR HYPERTROPHIC LAKES,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
R. J. Allan.
Environmental Pollution (Series B), Vol 1, No 3, p 217-231, 1980. 10 Fig, 2 Tab, 25 Ref.

Descriptors: *Eutrophication, *Lakes, *Chlorophyll, Trophic levels, Measurement, Photosynthesis, Phytoplankton, Aquatic life, Aquatic plants, *Canada.

Since 1970 a sporadic data base concerned with nutrient and chlorophyll-a concentrations in the Fishing Lakes and Crooked and Round Lakes has been gathering information under the guidance of the Water Pollution Control Branch, Environment Canada. A systematic bi-weekly survey of nutrient and chlorophyll-a concentrations was conducted in these same lakes between June 1977 and June 1978. During 1978 and 1979 weekly sampling of Rock Lake for nutrients and chlorophyll-a concentrations was carried out during the open water period. The data collected indicate that inaccuracies exist in prediction of lake phosphorus concentrations from phosphorus loading models and mean and maximum chlorophyll-a from lake phosphorus concentrations. The data also indicate that representative sampling to estimate true phosphorus

loading and true mean and maximum chlorophyll-a concentrations is not able to provide reliable information. Remedial measures may be taken to reduce external phosphorus loads, thus resulting in the reduction of long-term mean and maximum open-water summer chlorophyll-a concentrations. However, perturbations in phytoplankton biomass will still remain at such a level that short-term algal blooms or scums on any particular day may still be sufficiently intense for long-term improvements not to be deemed significant to the occasional recreational user of the water body. (Baker-FRC)
W81-02856

AFFINITY TESTS FOR THE DETECTION OF COMMUNITY ALTERATION IN PLANKTON: EVALUATION WITH A DISTRIBUTIONAL COMPUTER MODEL,
Georgia Univ., Athens. Dept. of Geology.
W. B. Hayes.
Environmental Pollution (Series B), Vol 1, No 2, p 127-148, 1980. 5 Fig, 8 Tab, 17 Ref.

Descriptors: *Phytoplankton, *Biological communities, *Computer models, Thermal stress, Model studies, Analytical techniques, Plankton, Fager test, Orloci test, Affinity testing, Sampling, Ecological distribution, Stochastic processes, Statistical methods, Temperature effects, Water pollution effects, Pollutant identification.

The Fager recurrent group analysis was found superior to the Orloci n-dimensional clustering procedure in environmental monitoring of a complex plankton community undergoing thermal stress. Although both affinity tests performed equally well in a model community study, the Fager method gave better results where repetitive samples were taken during a control-to-outfall transect, commonly employed in field studies. A spatial distribution model of species within the phytoplankton community was constructed by computer with built-in stochastic temporal community variations. The use of affinity tests can detect small changes in species variation, since all species are considered, not only indicator organisms. (Cassar-FRC)
W81-02860

ALGAL RESPONSE TO COPPER UNDER RIVERINE CONDITIONS,
State Univ. of New York Coll. at Buffalo. Dept. of Biology.
R. L. Klotz.
Environmental Pollution (Series A), Vol 24, No 1, p 1-19, January, 1981. 3 Fig, 12 Tab, 29 Ref.

Descriptors: *Algae, *Rivers, *Industrial wastes, *Copper, *Toxicity, Effluents, Chlorella, Scendesmus, Chlamydomonas, Water pollution sources, On-site data collection, Heavy metals, Metals, Absorption, Aquatic algae, Water pollution effects, Furnace Brook, *Connecticut.

Algae (Chlamydomonas sp., Scenedesmus sp., and Chlorella sp.) were grown in dialysis chambers immersed in Furnace Brook, Connecticut, for periods of a week throughout the year to determine the effects of a copper-containing effluent discharged from an upstream factory. Growth rates were highest in summer in spite of the highest Cu levels (135-687 micrograms per liter) and were correlated with temperature but not with dissolved Cu concentration of the water. Final Cu concentration in the cells ranged from 0 to 22.0 mg per g dry weight. Cu uptake rates were highest at optimal temperatures, which varied with species and Cu concentration. Algae in this river were tolerant of copper. (Cassar-FRC)
W81-02862

THE EFFECT OF A FLUORIDE EFFLUENT ON MARINE ORGANISMS,
Otago Univ., Portobello (New Zealand). Marine Lab.
N. W. Pankhurst, C. R. Boyden, and J. B. Wilson.
Environmental Pollution (Series A), Vol 23, No 4, p 299-312, December, 1980. 1 Fig, 6 Tab, 20 Ref.

Descriptors: *Marine organisms, *Toxicity, *Fluoides, Water pollution effects, *Industrial wastes, Effluents, Water pollution sources, Discharge(Water), Waste water disposal, Fertilizers, Mussels, Aquatic animals, Fish, Sole, Anemone, Cockle, Brine shrimp, Invertebrates, Shellfish, Fertilizer plant, *New Zealand.

Fluoride-containing effluent from a New Zealand fertilizer plant affected the distribution and abundance of marine organisms near the outfall. Encrusting fauna were counted in February and March 1978 at 18 stations 1 to 400 meters north of the outfall and at 2 stations 400 and 450 meters south of the outfall. Immediately adjacent to the outfall, no encrusting fauna were present. At 50 meters or less, relatively large numbers of bryozoans, ascidians, and bivalves were seen. Numbers increased toward the outer stations, with sponges, ascidians, and anemones appearing at a distance of 400 meters. Here only 1% of the rock examined was uncolonized. Additional counts in November-December 1978 and January 1979 showed similar patterns. Fluoride concentrations were high (10 ppm) in surface samples up to 10 meters from the outfall and dropped rapidly with distance to background levels. Sublethal toxicity tests on the brine shrimp, Artemia salina, showed adverse growth effects at all concentrations of fluoride, 5, 10, 15, and 20 ppm. After 12 days the controls reached a mean body length of 1.740 mm; those exposed to the highest fluoride concentration, 20 ppm, averaged 1.300 mm. Acute toxicity tests on 5 species revealed little mortality from 10 and 25 ppm F effluent or NaF solution, some mortality at 50 and 100 ppm NaF solution, and considerable mortality in all species at 50 and 100 ppm F effluent. (Cassar-FRC)
W81-02863

THE CHRONIC TOXICITY TO DAPHNIA MAGNA OF ACRIDINE, A REPRESENTATIVE AZAARENE PRESENT IN SYNTHETIC FOSSIL FUEL PRODUCTS AND WASTE WATERS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
B. R. Parkhurst, A. S. Bradshaw, J. L. Forte, and G. P. Wright.
Environmental Pollution (Series A), Vol 24, No 1, p 21-30, January, 1981. 6 Fig, 2 Tab, 12 Ref.

Descriptors: *Toxicity, *Daphnia, *Organic compounds, *Fuel, Synthetic fuels, Aquatic life, Invertebrates, Crustaceans, Acridine, Organic wastes, Water pollution sources, Water pollution effects, Azaarenes, Waste water, Reproduction, Pesticides.

The toxicity of acridine, an organic base present in synthetic fuel waste waters, was determined using first instar Daphnia magna. The 48 hour LC50 was 2.3 + or - 0.4 mg per liter. Chronic toxicity was judged by survival, occurrence of the primiparous instar, age at onset of reproduction, number of broods per female, number of young per brood, and total number of young per female. The estimated no-observed-effect concentration was 0.4 mg per liter; the lowest-observed-effect concentration 0.8 mg per liter. The least sensitive criterion was the occurrence of the primiparous instar; the most sensitive involved numbers of young and broods. Acridine was more toxic to Daphnia magna than most of the materials listed in a table of toxicities of organic acids, organic bases, and polyaromatic hydrocarbons found in sythetic fuel waste waters. However, its toxicity is less than that of the chlorinated hydrocarbon pesticides. (Cassar-FRC)
W81-02864

ENVIRONMENTAL IMPACT OF KRAFT PLANT EFFLUENTS ON SALMO SALAR OUANANICHE ANALYZED BY A NEW METHOD, THE COHERENCE GRAPH. (EVALUATION DES IMPACTS ENVIRONNEMENTAUX DUS AU REJETS D'UNE USINE DE PATE KRAFT SUR LE SALMO SALAR OUANANICHE A L'AIDE D'UNE NOUVELLE METHODE: LE GRAPHE DE COHERENCE),
Institut Nationale de la Recherche Scientifique Sainte-Foy (Quebec).
D. Couillard.
Environmental Pollution (Series B), Vol 2, No 2, p 145-161, 1981. 6 Fig, 2 Tab, 43 Ref.

Descriptors: *Paper pulp wastes, *Graphical analysis, Analytical techniques, Industrial wastes, Saw mills, Pulp and paper industry, Bleaching wastes, Water pollution sources, Phenols, Lakes, Canada, *Environmental effects.

A new approach based on graphs of coherence was evaluated for predicting the effect of a kraft pulp mill on water quality. Graphs of coherence were constructed to permit the systematic identification of the relationships between the mill and various components of the environment. A forestry complex consisting of a sawmill and kraft bleached pulp mill was established on the Chamouchouane River which flows into Lake St. John (Quebec, Canada). The graphs of coherence technique was applied to study the effects of the complex on lake species Salmo salar ouananiche. First, potential environmental impacts were determined, and second, the graph demonstrating the relationships between these impacts was constructed. This technique permits the rapid identification of serious environmental effects including avoidance effect, the presence of phenols, contact time, etc. (Small-FRC)
W81-02867

ACID LAKES FROM NATURAL AND ANTHROPOGENIC CAUSES,
Academy of Natural Sciences, Philadelphia, PA. Div. of Limnology and Ecology.
For primary bibliographic entry see Field 5B.
W81-02870

ISOLATION AND IDENTIFICATION OF AN AMES-MUTAGENIC COMPOUND PRESENT IN KRAFT CHLORINATION EFFLUENTS,
Pulp and Paper Research Inst. of Canada, Pointe Claire (Quebec).
For primary bibliographic entry see Field 5A.
W81-02875

SOME ECOLOGICAL OBSERVATIONS ON ENVIRONMENTAL PARAMETERS, PLANKTONIC SEASONAL SUCCESSION AND BIOMASS IN RIO CRUCES (PROV. VALDIVIA), SOUTH CHILE,
Giessen Univ. (Germany, F.R.). Inst. fuer Pflanzenoekologie.
M. Durrschmidt.
Archiv fur Hydrobiologie, Vol 88, No 3, p 345-363, April, 1980. 9 Fig, 59 Ref.

Descriptors: *Phytoplankton, *Seasonal, *Algae, *Cruces River, *Chile, Diatoms, Biomass, Plankton, Fluctuations, Aquatic plants, Ecology, Rivers, Brackish water, Estuaries, Valdivia River, Chlorophyll, Chlorophyta.

Phytoplankton were observed monthly from May 1975 to April 1976 in the Cruces River, Chile, an area relatively uninfluenced by man's activities. The paper defines the composition, relative abundance and seasonal distribution of the algae to provide base information for future limnological investigations. A tremendous earthquake in May 1980 caused inundation of the last 35 km of the river. A total of 382 algal taxa were counted: Chlorophyta, 249; Bacillariophyceae, 76; Cyanophyta, 29; Chrysophyceae, 13; Euglenophyta, 14; and Xanthophyceae, 1. Chrysophyceae and diatoms increased rapidly in winter (June-Aug.). Spring saw a sharp decline in Chrysophyceae and a great increase in green algae, especially desmids. Diatoms and green algae again increased in summer (Nov.-Dec.). During Jan.-April (autumn) brackish water entered and algae species and numbers were reduced. Total algal cells reached a peak in June and in Nov./Dec. and a minimum in Sept. The algal flora was rich in species and poor in individuals. (Cassar-FRC)
W81-02876

PRIMARY PRODUCTION OF PHYTOPLANKTON AND ENVIRONMENTAL CHARACTERISTICS OF A SHALLOW QUATERNARY LAKE AT EASTERN BRAZIL,

Universidade Federal de Minas Geris, Belo Horizonte (Brazil). Dept. of General Biology.
F. A. R. Barbosa, and J. G. Tundisi.
Archiv fur Hydrobiologie, Vol 90, No 2, p 139-161, October, 1980. 9 Fig, 6 Tab, 51 Ref.

Descriptors: *Phytoplankton, *Distribution patterns, *Lakes, Nutrient requirements, *Brazil, Lake Carioca, Temperature, Light, Nutrients, Plankton, Aquatic life, Aquatic plants, Aquatic microorganisms.

Research was conducted at Carioca Lake, Eastern Brazil, concerning studies of the standing stock and primary production of phytoplankton and critical environmental factors which may control or limit it. The lake system studied is at an elevation of about 300 meters in a physiographic area known as the Interplanaltic Depression of River Doce. The air temperature averages from 20 to 22C. A rainy and a dry season can be distinguished, with an average yearly rainfall of 1500 mm. The lakes are situated in a tropical rain forest. Five lakes were chosen for a comparative limnological study. Higher levels of primary production were noted in winter, and diurnal cycles of certain environmental factors such as temperature appear to affect the population activities. A deoxygenated layer is marked off by the thermal discontinuity during the period of strong stratification. Vertical profiles of photsynthesis exhibit light inhibition at the surface. Primary production values ranged from 0.32 mg C/cubic meter to 108.8 mg C/cubic meter per day. In the summer the dark fixation values were high, ranging from undetectable up to 90%. Low photosynthetic efficiencies were recorded. It appeared that the factors affecting seasonal variations were mainly concerned with nutrient supply rather than light and temperature variations. The absence of a thermocline in the winter was probably responsible for higher levels of production due to nutrient enrichment of the euphotic zone by mixing. (Baker-FRC)
W81-02878

TEMPORAL PATTERNS IN RECOLONIZATION OF STREAM BENTHOS,
Scarborough Coll., Toronto (Ontario). Div. of Life Sciences.
D. D. Williams.
Archiv fur Hydrobiologie, Vol 90, No 1, p 56-74, September, 1980. 11 Fig, 37 Ref.

Descriptors: *Benthos, *Streams, *Temporal distribution, Aquatic life, Aquatic microorganisms, Biota, Benthic environment, Environmental effects, Seasonal distribution.

Recolonization by stream benthos was studied over a period of a year in efforts to detect patterns of movement resulting from interactions of both biotic and abiotic influences so as to provide information on the temporal nature of benthic communities. The study was made in a 15 m long riffle on the upper east branch of Duffin Creek, Durham County, Ontario. The depth varied between 20 cm in midsummer and 60 cm during the spring runoff. During the winter months relatively low numbers of individuals and species colonized the stream when compared to summer months. It is suggested that water temperature was the significant factor in this difference. A negative correlation was found between numbers of animals colonizing the stream each month and water depth. No correlation was noted with amounts of either fine particulate organic matter or coarse particulate organic matter, as it settled in the substrates. Some evidence was found of seasonal mobility that probably was associated with a specific stage in the life cycle of individual species. It is suggested that caution be applied in stream studies where artificial substrate techniques are used to collect information concerning species composition and the effects of pollutants. (Baker-FRC)
W81-02883

PHOSPHORUS, CHLOROPHYLL, AND EUTROPHIC LAKES,
Alberta Univ., Edmonton. Dept. of Botany.
M. Hickman.
Archiv fur Hydrobiologie, Vol 88, No 2, p 137-145, March, 1980. 2 Fig, 2 Tab, 28 Ref.

Descriptors: *Phosphorus compounds, *Chlorophyll, *Eutrophication, *Eutrophic lakes, Standing crops, Phytoplankton, Lakes, Alberta, Canada, Oligotrophy, Model studies, Regression analysis, Trophic level, Nutrients.

The curvilinear regression equation, log chlorophyll a concentration = 3.27 log (log phosphorus concentration) + 0.542, was developed to predict summer phytoplankton standing crop size from measurements of total phosphorus concentration at spring overturn. This model applies to a wide range of lakes, from oligotrophic to eutrophic. The data used to derive the equation were collected from 12 eutrophic lakes in Alberta, Canada. However, in extremely eutrophic lakes with large standing crops, the physical factors of temperature, irradiance, and turbulence become increasingly important. (Cassar-FRC)
W81-02886

THE DISTRIBUTION OF THE POLYCHAETE CAPITELLA CAPITATA (FABRICIUS) IN DOCK SEDIMENTS,
Liverpool Polytechnic (England). Dept. of Biology.
C. J. James, and R. Gibson.
Estuarine and Coastal Marine Science, Vol 10, No 6, p 671-683, June, 1980. 4 Fig, 5 Tab, 38 Ref.

Descriptors: *Heavy metals, *Polychaetes, *Bioindicators, *Sediments, Benthic fauna, Capitella capitata, Invertebrates, Worms, Annelids, Water pollution effects, Docks, Metals, Copper, Zinc, Iron, Lead, Organic matter, Hydrogen sulfide, Sulfides, Mersey River, *Liverpool, England, Aquatic life.

The polychaete Capitella capitata appeared unaffected by heavy metal accumulations (all in parts per million: Cu 23.7, Fe 16, 368, Pb 327.8, and Zn 1089.6) in sediments of an enclosed non-tidal dock at Liverpool, England. Water in this area was subject to contamination by untreated sewage from a night club and spillage from gravel, sand, and molasses loading. A total of 1204 specimens from 13 species of invertebrates (Annelida and Arthropoda) were collected in the dock area. Species diversity was low, and Capitella accounted for 88.5% of the total animals. Polychaeta as a group were 95.5% of all fauna collected. Capitella was more prevalent in coarse sandy sediments (subject to mechanical instability, low levels of organic matter and high levels of heavy metals) than in the silt (stable, low oxygen, high organic matter and sulfides). (Cassar-FRC)
W81-02887

EVIDENCE FOR THE INCREASED EUTROPHICATION OF LAKE NAINITAL AS A RESULT OF HUMAN INTERFERENCE,
Kumaun Univ., Naini Tal (India). Dept. of Zoology.
M. C. Pant, A. P. Sharma, and P. C. Sharma.
Environmental Pollution (Series B), Vol 1, No 2, p 149-161, 1980. 4 Fig, 3 Tab, 43 Ref.

Descriptors: *Eutrophication, *Lakes, *Ecology, *Lake Nainital(India), Aquatic life, Water pollution effects, Nitrates, Nitrogen compounds, Phosphates, Phosphorus compounds, Environmental effects, Algae, Zooplankton, Invertebrates, Dissolved oxygen, Bioindicators, India.

The rapid eutrophication of Lake Nainital, India, was documented by measuring water quality parameters during September 1977-August 1978 and comparing results with historical data and indicators of eutrophication. Current observations, with 1954 data, if available, in parentheses, are as follows: Secchi transparency, 75-194 cm; dissolved oxygen in surface waters, 5.65-17.2 mg per liter; pH, 7.0-9.6; alkalinity, 110-520 ppm; total hardness, 400 ppm (300 ppm); ammonia N, 33-422 micrograms per liter (19.0); nitrate-N, 62.5-750 micrograms per liter (traces in 1954); and phosphate, 6.5-70 micrograms per liter. Biological indicators of eutrophication include the presence of Tubifex spp., Chironomus spp., Microcystis sp., and zooplankton common in eutrophied lakes. Bottom fauna are completely absent, as is the dinoflagellate Ceratium hirundinella. Both physico-chemical and biological criteria indicate that this lake is undergoing rapid eutrophication. (Cassar-FRC)
W81-02890

NON-RADIOLOGICAL ENVIRONMENTAL IMPLICATIONS OF NUCLEAR ENERGY,
Biswas and Associates, Oxford (England).
A. K. Biswas.
Environmental Conservation, Vol 7, No 3, p 229-237, Autumn, 1980. 1 Fig, 1 Tab, 48 Ref.

Descriptors: *Thermal water, *Powerplants, *Thermal pollution, *Nuclear powerplants, Temperature effects, Environmental effects, Aquatic life, Foreign projects, Ecosystems.

Thermal pollution caused by nuclear energy power plants may affect water-based ecosystems. Most experimental studies do not indicate major impacts such as massive fish kills, but the combined effects of pollutants and heat could be serious. Chemicals used to control corrosion, neutralize pH, or control biological fouling are often discharged into the water. Heat may also affect organisms' response to irradiation. Studies have shown that radiation damage is greater in animal cells also exposed to heat. There is some data on the possible benefits of thermal discharges. Possible uses are aquaculture and agriculture, space heating, industrial uses, and irrigation use. Increases in water temperature have been found to increase growth rates of shrimp, catfish, oysters, and other creatures. Heated irrigation water can prolong the growing season and prevent damage by early or late frosts. Land use impacts are also discussed. (Small-FRC)
W81-02895

USE OF SYNTHETIC DETERGENTS IN MALAYSIA,
Malaya Univ., Kuala Lumpur (Malaysia).
M. A. Quddus.
Environmental Conservation, Vol 7, No 4, p 287-288, Winter, 1980. 2 Ref.

Descriptors: *Detergents, *Malaysia, *Eutrophication, Phosphates, Lakes, Water pollution sources, Phosphorus compounds, Foreign countries, Water pollution control, *Water pollution effects.

Rising use of synthetic phosphate-containing detergents in Malaysia has been responsible for eutrophication of Taman Jaya, a lake in the suburban area of Kuala Lumpur. Although no eutrophication studies have defined the state of Malaysia's waters, it is believed that phosphates from laundry water, untreated sewage, industry, and agriculture are producing an enormous phosphate load. It is recommended that in developing countries phosphates be banned or their percentage lowered in detergents, since even primary sewage treatment facilities are minimal. (Cassar-FRC)
W81-02896

5D. Waste Treatment Processes

PROCESS FOR REMOVAL OF DISCRETE PARTICULATES AND SOLUTES FROM LIQUIDS BY FOAM FLOTATION,
J. H. Hoge, and J. H. Hubbard.
U.S. Patent No 4,203,837, 15 p, 13 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 994, No 3, p 985, May 20, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Foam separation, Surfactants, Bubbles, Floating, Absorption, Pregenerated foam.

A process removes discrete particulates from liquids by foam flotation which is readily adaptable to continuous or batch processing. A continuous stream of foam, in which the gaseous medium is subdivided into individual bubbles, each encapsulated in a film consisting of a foaming agent solution, each film being shared with each adjacent gas cell, is pregenerated. The composition of the films of the pregenerated foam may include, in addition

to the foaming agent, other agents or reagents useful or necessary for the collection and removal of the solid or solute material being extracted by counter ion action. The pregenerated foam is then introduced at a predetermined rate into the liquid carrying the solids or solutes and is dispersed. The preformed surfactant films of the bubbles contact and attach the solid particles by counter ion action from the liquid during the progress of the foam bubbles through the liquid. The loaded foam bubbles are allowed to float to the surface where they consolidate into a stable foam layer for convenient removal. Dissolved materials in the liquid body are similarly extracted by use of film having composition suitable for ionic adsorption or reagents for precipitation of the soluble material on or within the film. (Sinha-OEIS)
W81-02660

A SOLAR HEATED FISH HATCHERY WATER RECYCLING SYSTEM,
Sea Run, Inc., Kennebunkport, ME.
For primary bibliographic entry see Field 8I.
W81-02709

ADVANCED PRETREATMENT PROCESS FOR WASTE WATER REUSE USING REVERSE OSMOSIS,
FilmTec Corp., Minneapolis, MN.
R. J. Petersen, R. S. King, C. R. Bennett, and J. E. Cadotte.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-197600, Price codes: A05 in paper copy, A01 in microfiche. Office of Water Research and Technology Report OWRT/RU-80/3, September, 1980. 81 p, 25 Fig, 33 Tab, 15 Ref. OWRT-C-80274-R(No 8804)(1), 14-34-0001-8804.

Descriptors: *Water reuse, Waste water renovation, *Membrane processes, *Reverse osmosis, Ultrafiltration, Waste water treatment, Oil wastes.

Colloidal and dissolved organic matter was shown to be a primary foulant in reverse osmosis treatment of wastewaters for reuse. A two-phase study was conducted on pretreatment methods to remove these organic foulants. In the first phase, river water and petroleum refinery effluent were treated with inorganic coagulants (ferric chloride and alum) under a variety of conditions. The clarified waters were then tested for fouling potential in reverse osmosis, at high membrane fluxes (25 to 35gfd) to accentuate fouling rates. Fouling flux decline was nearly always encountered; also, organic removal was ineffective. In Phase II, a novel set of thin film composite ultrafiltration membranes were developed. These consisted of anionic methyl cellulose graft copolymers deposited as membranes on microporous supports. These membranes removed organic foulants from river water and petroleum refinery effluent, and were fairly effective on municipal secondary effluent in ultrafiltrations at 50 psi.
W81-02710

USE OF CALCIUM STRIPPING COLUMN TO ACHIEVE ENERGY CONSERVATION AND RESIDUE REUSE IN PHOSPHATE PRECIPITATION BY LIME,
Missouri Univ.-Rolla. Dept. of Civil Engineering.
J-C. Huang, Y. A. Sun, and C. S. Liu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-197634, Price codes: A04 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri, Completion Report, November, 1980. 47 p, 12 Fig, 11 Tab, 6 Ref. OWRT-A-109-MO(1), 14-34-0001-9027 & 0127.

Descriptors: Calcium carbonate, *Chemical precipitation, Fluidized beds, *Hydroxylapatite, Lime, *Phosphorus removal, *Water pollution control, *Waste treatment.

This study was undertaken to evaluate the feasibility of using a fluidized sand bed to coprecipitate the insoluble phosphorus complex of hydroxylapatite with calcium carbonate on the surface of sand grains to form dry chemical pebbles. It was found that the operation of such a new technique was simple and it required a contact time of only 5 min. At pH 10.0, the concentration of P in raw sewage was reduced from 8 mg/L to about 3 mg/L. Also, about 50 to 70% of calcium carbonate was able to plate out on the surface of sand grains. If the influent was allowed to settle for 1 hr, the residual P was further reduced to 1 mg/L, and most of the remaining suspended solids could settle out effectively.
W81-02713

SURVEY AND CONTROL OF SYNTHETIC ORGANICS IN TEXAS WATER SUPPLIES,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 5A.
W81-02719

THE EFFECT OF HEAVY METALS ON THE PERFORMANCE OF ROTATING BIOLOGICAL CONTACTORS (RBC),
Oklahoma State Univ., Stillwater.
F. G. Dehkordi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198434, Price codes: A04 in paper copy, A01 in microfiche. Master of Science Thesis, July, 1980. 51 p, 21 Fig, 9 Tab, 31 Ref. OWRT-A-087-OKLA(3).

Descriptors: *Biological waste water treatment, *Waste water facilities, *Water quality control, *Heavy metals, *Chemical oxygen demand, Waste water, Sewage, Waste water purification, Waste water treatment, Biological treatment, Sludge seeding, Biodegradation, Treated water, Water treatment, Research priorities, Evaluation, Chromium, Copper, Trace metals, Water pollution control.

Addition of hexavalent chromium (Cr) in the form of potassium chromate at concentrations of 1, 2, and 3 milligrams/liter (mgpl) did not decrease chemical oxygen demand (COD) removal efficiency of the rotating biological contactors (RBC) employed, but Cr at 20 mgpl did. When the RBC recieved wastewater containing potassium dichromate it removed 65-80% metal at concentrations of 1,2,3, and 20 mgpl. Hexavalent Cr (as the chromate salt) at 1-4 mgpl did not affect COD removal efficiency of the RBC. Removal efficiency of the chromate salt by the RBC was almost 100% at 1-2 mgpl, but only 68 and 62% of the Cr was removed at 3 and 4 mgpl, respectively. When hexavalent Cr was fed to the RBC in both salt forms, microbial growth was stimulated on the rotating discs relative to control conditions. RBC receiving waste waters containing copper (cupric sulfate) had higher COD removal efficiency at hydraulic loadings of 0.7 and 3 gallons/day/square-foot relative to the control, with copper removal considerably higher at the latter hydraulic loading. (Zielinski-IPA)
W81-02723

HOOVER DAM ADVANCED WASTE TREATMENT SYSTEM; VOLUME I, PILOT STUDIES REPORT.
Montgomery (James M.), Inc., Pasadena, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-180309, Price codes: A12 in paper copy, A01 in microfiche. Water and Power Resources Service, Boulder City, Nevada, Report, January, 1981. 257 p, 52 Fig, 79 Tab, 4 Append. 9-07-30-V0471.

Descriptors: *Waste water treatment, *Advanced waste water treatment, *Reverse osmosis, *Recreation wastes, Coagulation, Flocculation, Biological waste water treatment, Sedimentation, Filtration, Effluent limitations, Fouling, Hoover Dam, Pilot plants.

The advanced waste treatment plant at Hoover Dam is a facility capable of producing a high quality effluent. Included among the unit processes are a conventional activated sludge process, lime clarification, dual media filtration, cartridge filtration, and reverse osmosis. The objectives of the study were: to operate the treatment plant to produce an effluent of sufficient quality to satisfy stringent effluent discharge requirements; and to conduct performance tests of the reverse osmosis unit. The waste water can be classified as a dilute sanitary waste with extreme diurnal flow variations, typical of a facility which would be visited by a large number of tourists. Six treatment trains were evaluated in a bench-scale test program, and based on this data, two treatment trains were analyzed in full-scale tests. Treatment train No. 1 comprised secondary biological treatment; lime coagulation, flocculation and sedimentation; dual media pressure filtration, cartridge filtration; and reverse osmosis. Treatment train No. 2 comprised lime coagulation, flocculation and sedimentation of raw sewage; dual media pressure filtration; cartridge filtration; and reverse osmosis. Both treatment trains were capable of meeting the proposed stringent effluent discharge requirements. Uncontrolled biological growth in the reverse osmosis system presented problems in both treatment trains. Thin film composite polyamide membranes performed better than cellulose acetate membranes in the reverse osmosis unit as part of the second phase operation of treatment train No. 1. (Moore-SRC)
W81-02772

HOOVER DAM ADVANCED WASTE TREATMENT SYSTEM: VOLUME II, PILOT STUDIES SUMMARY DATA.
Montgomery (James M.), Inc., Pasadena, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-180317, Price codes: A13 in paper copy, A01 in microfiche. Water and Power Resources Service, Boulder City, Nevada, Report, January, 1981. 222 p, 14 Tab. 9-07-30-V0471.

Descriptors: *Advanced waste water treatment, *Waste water treatment, *Reverse osmosis, Recreation wastes, Filtration, Coagulation, Sedimentation, Flocculation, Biological waste water treatment, Turbidity, Particulate matter, Fouling, Hoover Dam, Pilot plants.

The objectives of this study were to operate the Hoover Dam Advanced Waste Treatment plant to produce an effluent of suffient quality to satisfy stringent effluent discharge requirements and to conduct performance tests of the reverse osmosis unit. This volume of the report provides tables of summarized data collected during full scale plant operation. Treatment train No. 1 comprised secondary biological treatment; lime coagulation, flocculation and sedimentation; dual media pressure filtration; cartridge filtration; and reverse osmosis. Treatment train No. 2 comprised lime coagulation, flocculation and sedimentation of raw sewage; dual media pressure filtration; cartridge filtration; and reverse osmosis. The data are presented in three sections corresponding to the chronological order in which the project was conducted. Section I contains information from the operation of treatment train No. 2 with cellulose acetate membranes in the reverse osmosis unit. Section II contains data from the operation of treatment train No. 1 with cellulose acetate membranes in the reverse osmosis unit. Section III contains information from the operation of both treatment trains with a combination of cellulose acetate and thin film composite polyamide membranes in the reverse osmosis unit. Data on turbidity, particle count, plugging index, unit process performance, and system performance are included. (Moore-SRC)
W81-02773

LABORATORY AND FIELD EVALUATION OF NS-100 REVERSE OSMOSIS MEMBRANE,
Abcor Inc., Wilmington, MA. Walden Div.
K. J. McNulty, D. C. Grant, J. R. Harland, and R. L. Goldsmith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-186026, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-059, April, 1980. 35 p, 11 Fig, 1 Tab, 6 Ref. R803753.

Descriptors: *Reverse osmosis, *Semipermeable membranes, *Metal-finishing wastes, *Zinc cya-

nide, Alkalinity, Deterioration, Waste water treatment, Water pollution control, Field tests, Evaluation, Membranes.

In an attempt to extend the applicability of reverse osmosis (RO) to the high-pH cyanide rinsewaters, laboratory life tests were conducted with B-9 and NS-100 RO membranes treating zinc cyanide plating solution at 10% of bath strength. The B-9 membrane was degraded by the high pH of the solution which was beyond the upper pH limit (pH 11) recommended for this membrane. The NS-100 membrane showed little deterioration in performance over the first 500 h of operation. A reduction in permeate flux and rejection after 500 h appeared to be due to precipitation of salts which resulted from operation in the closed loop test system and would not be expected in actual field operation. Field tests were conducted at New England Plating Company treating rinsewater from the zinc cyanide plating operation with a module of seven tubular NS-100 RO membranes. Conductivity rejections of 80-96% and zinc rejections of 96-99.7% were measured at flux levels of 0.20-0.37 cu m/sq m/day (5-9 gal/sq ft/day). During 2300 h of exposure to the rinsewater, the membrane showed no degradation in performance as determined by NaCl performance tests and standard tests with a solution of zinc cyanide plating bath diluted to 5% of bath strength. A number of attempts were made to fabricate an NS-100 spiral-wound module, but all were unsuccessful. Further development will be required before the NS-100 can be commercially offered in an economically attractive configuration. (Brambley-SRC)
W81-02777

OVERLAND FLOW: REMOVAL OF TOXIC VOLATILE ORGANICS,
Cold Regions Research and Engineering Lab., Hanover, NH.
T. F. Jenkins, D. C. Leggett, C. J. Martel, and H. E. Hare.
Army Corps of Engineers Special Report 81-1, February, 1981. 19 p, 6 Fig, 10 Tab, 33 Ref, 1 Append.

Descriptors: *Overland flow, *Chlorinated hydrocarbons, *Waste water treatment, Municipal waste water, Volatility, Chlorination, Disinfection, Mathematical models, Kinetics.

Chlorine disinfection of water and wastewater produces a number of volatile organics of which haloforms are the volatile organochlorine compounds produced in highest concentration. A small-scale overland flow system was studied to determine its effectiveness in reducing the levels of volatile trace organics in municipal waste water. The prototype system is 30.5 m in length by 8.8 m wide, and was subdivided into three parallel test sections. Waste water was applied at five different rates ranging from 0.40 to 1.32 cm/hr. The period of application was generally seven hours a day, five days per week. Chlorinated primary waste water, water collected from the surface at various points downslope, and runoff were analyzed by gas chromatography/mass spectrometry using a purge and trap sampler. The results indicated that overload flow was effective in reducing the levels of these substances by 80-100% depending on the specific substance and the application rate. The removal mechanism was found to follow first order kinetics. The most likely mechanism to explain the observed behavior is volatilization. Comparison of the experimental results with theoretical prediction using published models resulted in reasonable agreement, considering the complexity of the system compared to the model systems. (Moore-SRC)
W81-02779

CAPROLACTAM RECOVERY FROM AQUEOUS MANUFACTURING STREAMS,
Union Carbide Corp., Tarrytown, NY.
J. H. Dibble.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-197999, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-062, April, 1980. 56 p, 15 Fig, 9 Tab, 8 Ref, Append, R-803737.

Descriptors: *Waste water treatment, *Industrial waste water, *Process water, *Waste recovery, *Pilot plants, Organic solvents, Effluent streams, Conservation, Adsorption, Physical properties.

A pilot plant was developed from the laboratory scale process for caprolactam recovery from aqueous wash streams. Caprolactam is extracted by dodecylphenol, a high-boiling solvent, and recovered from the extract by distillation. The resulting aqueous effluent caprolactam concentrations were as low as 30 ppm. Further treatment by activated carbon adsorption reduced the level to less than 2 ppm. Various physical properties, which are needed for this process design, were determined. Vapor pressures for the key components were determined using a special high-temperature, low-pressure (vacuum) apparatus. Other properties investigated include: density; solubilities of water in dodecylphenol and dodecylphenol in water; the interfacial tension of the water-caprolactam-dodecylphenol system; and the viscosities of pure dodecylphenol and dodecylphenol-heptane systems. This process is more efficient in extraction and less energy-consuming than current commercial processes. (Brambley-SRC)
W81-02783

THE FEASIBILITY OF A REGIONAL INDUSTRIAL WASTE WATER TREATMENT FACILITY,
Datagraphics, Inc., Pittsburgh, PA.
H. C. Bramer, and C. A. Caswell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-195787, Price codes: A05 in paper copy, A02 in microfiche. Environmental Protection Agency Report EPA-600/2-80-065, April, 1980. 76 p, 5 Fig, 21 Tab, 74 Ref, 1 Append. R804182.

Descriptors: *Waste water treatment, *Industrial waste water, *Waste water facilities, *Feasibility studies, *Monongahela River, Pennsylvania, Industrial plants, Sewer systems, Process water, Cooling water, Costs, Water quality standards.

The feasibility of establishing a regional industrial waste water treatment facility to serve the 68 industrial plants along the lower reaches of the Monongahela River, Pennsylvania, has been studied. A facility consisting of an interceptor sewer system following the river course with a treatment plant near the point at Pittsburgh is technically possible. The facility would best be designed to treat up to 568,000 cu m/day (150 mgd) of waste water consisting of 10% of the presently discharged process water and 10% of the presently discharged unsegregated, non-contact cooling water. The construction and operation would be best handled by the Allegheny County Sanitary Authority and funded by revenue bonds backed by long-term contracts from industrial users. Obstacles to the implementation of the scheme include the lack of effluent guidelines, and cost to and unwillingness to make long-term commitments by industry. While such a facility in this area is technically possible, it is neither economically nor institutionally feasible. (Brambley-SRC)
W81-02786

MULTI STAGE FLOCCULATION TREATMENT SYSTEM,
Houdaille Industries, Inc., Fort Lauderdale, FL.(Assignee).
M. G. Mandt.
U S Patent No 4,206,052, 10 p, 3 Fig, 4 Tab, 3 Ref; Official Gazette of the United States Patent Office, Vol 995, No 1, p 228, June 3, 1980.

Descriptors: *Patents, *Waste water treatment, Water pollution treatment, *Flocculation, Coagulation, Chemical reactions, Mixing, Turbulence, Hydrostatic pressure.

A system is described for flocculation processing in water purification treatment in which a first jet flash mixing field of relatively high specific energy requirement and turbulence intensity is provided for intimate mixture of the flocculant and influent water to produce a thoroughly mixed product stream having residual energy, and in which the product stream from the first mixing field is used as the motive stream to power a flocculation field of lower specific energy requirement and turbulence intensity. (Sinha-OEIS)
W81-02805

THE EFFECT OF PH ON THE COAGULATION AND PURIFICATION OF WASTEWATER,
Ministry of Works and Housing, Ibadan (Nigeria).
C. M. A. Ademoroti.
Effluent and Water Treatment Journal, Vol 20, No 11, p 541, 544-546, 549, November, 1980.

Descriptors: *Water purification, Acidity, *Coagulation, *Alum, Waste water treatment, *Ferric chloride, Water treatment, Water quality control, Waste treatment, Water pollution treatment, *Hydrogen ion concentration.

Alum and ferric chloride were used for the coagulation of wastewater. Two sets of samples were coagulated with 100, 200, 300, 400, 500 or 600 mg/l alum and with 50, 100, 200, 300, 400, and 500 mg/l ferric chloride. They were filtered through sand, and the effluents were analyzed. The doses giving the highest reductions in color, suspended solids, BOD and COD were 400 mg/l alum and 300 mg/l ferric chloride. When pH values were adjusted to 4.8, purest effluents were obtained at 200, 300 and 400 mg/l ferric chloride, as shown by COD values. Ferric chloride proved effective at lower concentrations than alum. The effluents of both coagulants were generally acidic in character, and the attainment of pH 4.8, where coagulation was optimum, created a medium for effective disinfection performance by hydrochlorous acid, an active species obtained during chlorination. The method of wastewater treatment by coagulation is simple and can be a suitable alternative for the secondary treatment in conventional methods of treatment. (Baker-FRC)
W81-02832

MODELING SEWAGE SLUDGE DECOMPOSITION IN SOIL: 1. ORGANIC CARBON TRANSFORMATION,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Soils and Crops.
Y. P. Hsieh, L. A. Douglas, and H. L. Motto.
Journal of Environmental Quality, Vol 10, No 1, p 54-59, January-March, 1981. 5 Fig, 3 Tab, 20 Ref. OWRT-A-038-NJ(4).

Descriptors: *Sewage sludge, *Degradation, *Model studies, Sludge treatment, Regression analysis, Biodegradation, Laboratory tests, Recycling, Waste treatment, Soil amendments, Activated sludge, Organic matter, Loam, Carbon.

To ensure beneficial results of waste recycling on agricultural land, the decomposition patterns of different types of sewage sludge in various soils should be examined under a number of environmental conditions. Laboratory mineralizations of an activated and a digested sludge were carried out in brown bottles, and decomposition was monitored through CO2 evolution measured by a modified biometer system. Greater mineralization was observed in the activated sludge than in the digested sludge due to its high active organic carbon content. After approximately 2 months, the mineralization rates of both sludges approached a square foot function of time. At 22 degrees, the mineralization of sewage sludges was found to be proportional to the application rate. At 8-22 degrees, the mineralization rate increased about 1.9 times for each 10 degree increase in temperature. Moisture levels of 0.06-0.33 bars had no significant effects on the mineralization rates of the sludges. A regression model was devised utilizing an exponential relationship of the cumulative organic carbon mineralized to the parameters of time, sludge rate and temperature. Due to its simplicity, the model may readily be applied to simulation analyses of sewage sludge decomposition in soil under various environmental conditions. (Geiger-FRC)
W81-02837

MODELING SEWAGE SLUDGE DECOMPOSITION IN SOIL: II. NITROGEN TRANSFORMATIONS,

Rutgers - The State Univ., New Brunswick, NJ. Dept. of Soils and Crops.
For primary bibliographic entry see Field 5E.
W81-02838

EVIDENCE FOR COMETABOLISM IN SEWAGE,
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
For primary bibliographic entry see Field 5B.
W81-02849

THE COMPARISON OF SOY-BEAN WASTES, USED TEA LEAVES AND SEWAGE SLUDGE FOR GROWING CHLORELLA PYRENOIDOSA,
Chinese University of Hong Kong, Shatin. Dept. of Biology.
M. H. Wong, and C. C. Lay.
Environmental Pollution (Series A), Vol 23, No 4, p 247-259, December, 1980. 9 Fig, 3 Tab, 19 Ref.

Descriptors: *Agriculture, *Algae, *Sludge, Nutrients, Metals, Organic matter, Industrial wastes, *Chlorella, Growth rates, Cultures, Waste water treatment, Activated sludge, Sewage sludge, Copper, Lead, Manganese, Iron, Trace elements, Heavy metals, *Soybean wastes, *Tea leaf wastes.

Chlorella pyrenoidosa, a unicellular green alga, was cultured in aqueous extracts of sewage sludge, soybean residues, and used tea leaves. The 2% soybean residue extract produced the highest growth rate, followed by 2% sludge extract, Bristol medium (control), and 1% tea leaves extract. Algal cells cultured in sludge extract contained higher levels of metals, Cu 0.06 mg per g, Mn 0.08 mg per g, and Fe 13.9 mg per g, than the soybean and Bristol medium substrates. Although the sewage sludge was of domestic water rather than industrial waste origin, it inhibited algal growth for the first few days. Studies of effects of metal concentrations on growth rates of algae showed that low levels accelerated growth but higher levels were inhibitory. The studies of effects of pH on growth rate showed that pH 7 supported better growth than pH 6.4. In more acidic media such as used tea leaf extract, growth was poor and trace metal solubilities enhanced, in spite of the presence of essential nutrients. (Cassar-FRC)
W81-02861

CLAY IS MOSINEE'S CHOICE FOR REDUCING TSS DISCHARGE FROM CLARIFIER,
Wisconsin Univ., Stevens Point. Dept. of Paper Science and Engineering.
J. M. Lassa.
Tappi, Vol 64, No 3, p 181-182, March, 1981. 1 Fig, 1 Tab.

Descriptors: *Pulp wastes, Clays, Polymers, *Suspended solids, *Waste water treatment, Mosinee Paper Corporation.

Clay was the most cost-effective and efficient additive for reducing total suspended solids in effluent from the secondary clarifier at Mosinee Paper Corporation's kraft mill. Other additives used in jar tests were alum, coal boiler fly ash, and commerical polymers (strongly anionic, moderately anionic, strongly cationic, nonionic, and cationic weighting agent). Optimum dosage was 10 ppm or 83.4 lb per million gal of secondary waste water. The Mosinee Mill treatment plant treats 12 million gal per day of waste water. (Cassar-FRC)
W81-02874

PHOSPHATE REMOVAL WITH CALCIUM CARBONATE PRECIPITATION IN THE LAKE OF CONSTANCE (OBERSEE). (PHOSPHATELIMINATION DURCH AUTOCHTHONE CALCITFALLUNG IM BODENSEE-OBERSEE),
Staatliches Inst. fuer Seenforchung und Fischereiwesen, Langenargen (Germany, F. R.).
H. Rossknecht.
Archiv fur Hydrobiologie, Vol 88, No 3, p 328-344, April, 1980. 3 Fig, 5 Tab, 17 Ref.

Descriptors: *Phosphorus, *Calcium carbonate, *Chemical precipitation, *Water pollution control, Lakes, Heavy metals, Acids, Separation techniques, Water treatment, Germany, Lake of Constance(Obersee).

The extent of phosphate coprecipitation in calcite was investigated because precipitation with CaCO3 can be used to remove organic acids or heavy metals from lake water. The phosphate content in the suspended matter and in the calcareous crusts on the leaves of Potamogeton lucens was determined by disintegrating the particles with carbon dioxide. Also, the phosphorus coprecipitation rate was measured in CaCO3 precipitation experiments with supersaturated lake water and Ca(HCO3)2 solutions. The concetration of particulate CaCO3 was determined in 1975 through 1978 in Lake Constance water, and the data were used to estimate the epilimnetic CaCO3 production. The amount of phosphorus eliminated by the lake's self-cleaning mechanism was estimated. (Small-FRC)
W81-02882

INDUSTRIAL WASTEWATER VS. THE POTW,
Black and Veatch Kansas City, MO.
J. Stukenberg, and J. D. Copeland.
American City and County, Vol 96, No 1, p 41-43, January, 1981. 1 Tab.

Descriptors: *Waste water treatment, *Industrial wastes, *Design criteria, Activated sludge, Municipal wastes, Treatment facilities, Cities, North Kansas City, *Missouri.

Existing municipal waste water treatment works (publicly owned treatment works, POTW) can successfully accommodate additional industrial waste water or upgrade the effluent quality with appropriate modifications. This is especially desirable when the industries provide substantial employment for the local residents. An example is given featuring North Kansas City, Missouri, population 6,000 people and 20 industries. The treatment plant had experienced problems with variable influent quality and corrosion by acid wastes. The design for the enlarged plant was based on analysis of plant records and data from the larger industrial dischargers. All plans were discussed with the industries, and most decided that discharge into the municipal plant without pretreatment would be economical. An oxygen activated sludge system, secondary clarifiers, and modifications to the sludge handling system were planned. Influent pH will be continually monitored. Along with the plant enlargement and modification, the testing laboratory will be expanded. (Cassar-FRC)
W81-02884

POLAND LAUNCHES MAJOR PROGRAM TO RESTORE AND REGULATE COUNTRY'S LARGEST RIVER SYSTEM,
E. Pudlis.
Ambio, Vol 10, No 1, p 41-43, 1981. 2 Fig.

Descriptors: *Poland, *Water resources development, *Rivers, *Vistula River, *Water pollution control, Planning, Water policy, Surface waters, Waste water treatment.

Poland has initiated a program to clean up and improve the Vistula River. Plans include 30 stages of locks and dams, 16 reservoirs with a total annual capacity of 6 billion cubic meters, and a number of hydroelectric power stations. The present heavily polluted condition of the river will be improved with 188 new large group purification plants (capacity 5.7 billion cu meters), 200 industrial treatment plants for processing particularly toxic sewage, and desalination facilities to mitigate salt leaching from coal mines. First signs of improvement in water quality are expected to be evident in 1990. (Cassar-FRC)
W81-02889

RECONSTRUCTION OF MALDON STW,
M. D. Elder, J. G. Evance, and D. J. Cooper.
Effluent and Water Treatment Journal, Vol 20, No 12, p 587-589, December, 1980. 2 Fig, 1 Tab.

Descriptors: *Sewage treatment, *Aeration, Waste water treatment, Biological treatment, Costs, Economics, *Estuaries, Odor, Aerated lagoons, Design criteria, Water pollution, Domestic wastes, Sewage sludge, Maldon, *Great Britain.

The town of Maldon on the estuary of the Blackwater supports various light industries and recreation through its boating facilities. Untreated sewage from the town found its way into the estuary and caused pollution and odor problems. In the 1960's, a biological filter installation was opened near Osea Island to handle flow from a population of 13,500. By 1969, the capacity of the plant had been exceeded. In 1974, a commission set up by the Essex Sewage Division studied the problem at Osea and reported on the options that might be taken within the appropriate cost limitations to upgrade the treatment of the town's waste water facilities to handle a population of 18,000. An extended aeration process was recommended which would reduce manpower requirements, eliminate odoriferous primary sludges, reduce fly nuisance, and allow disposal of a well oxidized sludge onto farm land. Design criteria were chosen and the uprated facility was located four kilometers from Maldon to serve the catchment area of Maldon and Heybridge. After 13 months of operation, the quality of the plant effluent has remained within the set standards and averages 11 milligrams/liter suspended solids and 7 milligrams/liter biochemical oxygen demand. Some minor problems have occurred with instrumentation and small trash deposition on sludge return valves, but these difficulties are being handled by further research. (Geiger-FRC)
W81-02899

5E. Ultimate Disposal Of Wastes

PERMEABILITY OF COVERS OVER LOW-LEVEL RADIOACTIVE-WASTE BURIAL TRENCHES, WEST VALLEY, CATTARAUGUS COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
D. E. Prudic.
Geological Survey Water-Resources Investigations 80-55, 1980. 35 p, 12 Fig, 4 Tab, 18 Ref.

Descriptors: *Permeability, Hydraulic conductivity, Porosity, *Infiltration, Atmospheric pressure, *Radioactive waste disposal, Soil water movement, Groundwater movement, Water levels, Groundwater recharge, Till, Hydrogeology, Evaluation, *New York, West Valley, Cattaraugus County, Burial trenches, Trench cover.

Among the facilities at the Western New York Nuclear Service Center, near the hamlet of West Valley in the northern part of Cattaraugus County, N.Y., is a State-licensed burial ground for commercial low-level radioactive wastes. The 11-acre burial ground contains a series of trenches excavated in a silty-clay till of low permeability that contains scattered pods of silt, sand, and gravel. Gas pressure in the unsaturated parts of radioactive waste burial trenches responds to fluctuations in atmospheric pressure. Measurements of atmospheric pressure and the differential pressure between the trench gas and the atmosphere on several dates in 1977-78 were used to calculate hydraulic conductivity of the reworked silty-clay till that covers the trenches. Generally the hydraulic conductivity of covers over trenches that had a history of rapidly rising water levels are higher, at least seasonally, than covers over trenches in which the water level remained low. This supports the hypothesis that recharge occurs through the cover, presumably through fractures caused by desiccation and (or) subsidence. Hydraulic conductivities of the cover as calculated from gas- and air-pressure measurements at several trenches were 100 to 1,000 times greater than those calculated from the increase in water levels in the trenches. This difference suggests that the values obtained from the air- and gas-pressure measurements need to be adjusted and at present are not directly usable in groundwater flux calculations. The difference in magnitude of values may be caused by rapidly decreasing hydraulic conductivity during periods of recharge or by the clogging of fractures with sediment washed in by runoff. (USGS)

W81-02692

EFFECTS OF FLY ASH HEAVY METALS ON DAPHNIA MAGNA,
Missouri Univ.-Kansas City. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W81-02715

WASTE WATER SPRAY TRANSPORT IN LAND APPLICATION,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 3F.
W81-02722

THE STATISTICAL DISTRIBUTION OF SEWAGE AND SLUDGE ANALYSES,
Oxford Univ. (England), Dept. of Agricultural Science.
For primary bibliographic entry see Field 5A.
W81-02817

ELEMENTAL CONTENT OF VEGETABLES AND APPLE TREES GROWN ON SYRACUSE SLUDGE-AMENDED SOILS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Office of Occupational Health and Safety.
A. K. Furr, T. F. Parkinson, D. C. Elfving, C. A. Bache, and W. H. Gutenmann.
Journal of Agricultural and Food Chemistry, Vol 29, No 1, p 156-160, January-February, 1981. 6 Tab, 23 Ref.

Descriptors: *Heavy metals, *Soil amendments, *Absorption, *Sewage sludge, Vegetable crops, Apples, Fruit crops, Hydrogen ion concentration, Sludge treatment, *Fertilizers, Municipal wastes, Polarographic analysis, Syracuse, New York.

The magnitude of Cd, Cu, Ni, Pb, and Zn uptake by a variety of vegetables and apple trees grown in soils amended with municipal sludge at pH values of 6.4 and 6.9 was examined. Two successive crops of peppers, kohlrabi, lettuce, peas, spinach, sweet potatoes, and turnips and two commercial apple cultivars were grown in neutral or sludge-amended soils or their mixtures in pots under laboratory conditions. Analysis for the metals in the edible portion of the drops was performed by conventional stripping voltammetry. Cd, Cu, Ni, and Zn levels were higher in the edible portions of sludge-grown crops. Cd, Ni, and Zn were generally elevated in vegetable crops grown on sludge fortified acid soil. Cu was elevated in the vegetables raised on the sludge-neutral soil mixture. During the second year of growth, Ni and Zn were decreased in vegetable crops and apple trees grown on sludge amended soil. Variations of heavy metals in apple trees showed no consistent relationship with soil pH. Zn and Cu tended to concentrate in apple twigs, while Pb and Ni were found at concentrated levels in apple tree leaves. Since leafy vegetables such as lettuce or spinach absorb very high levels of Cd, Zn and Cu, the growth of these crops on municipal sludge amended soils should be avoided. (Geiger-FRC)
W81-02830

MODELING SEWAGE SLUDGE DECOMPOSITION IN SOIL: II. NITROGEN TRANSFORMATIONS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Soils and Crops.
Y. P. Hsieh, L. A. Douglas, and H. L. Motto.
Journal of Environmental Quality, Vol 10, No 1, p 59-64, January-March, 1981. 3 Fig, 4 Tab, 25 Ref. OWRT-A-038-NJ(5).

Descriptors: *Denitrification, *Sewage sludge, *Model studies, Recycling, Soil amendments, Activated sludge, Sludge disposal, Nitrification, Nitrogen, Agriculture, Degradation, Kinetics, Laboratory tests, Sludge treatment, Organic matter.

The recycling of sewage sludge on agricultural land has been used as a method to ease some of the problems of sewage sludge disposal. The ability of soil to decompose sewage sludge was studied in laboratory tests. The transformation of nitrogen was studied in sandy loam soils amended with an anaerobically digested or an activated sewage sludge. The active organic carbon content and moisture level of the sludge-soil system was found to influence the duration of the lag phase of nitrification. The potential for mineralization of nitrogen was 30% of the organic nitrogen in the activated sludge and 38% of the organic nitrogen in the digested sludge. At 21 degrees, the mineralization rate constant was 0.026/day, corresponding to a 27-day half life. Moisture levels of 0.06 and 0.33 bars had no significant effect on the rate of nitrogen mineralization. Under unsaturated conditions, denitrification and nitrification could proceed either alternatively or simultaneously in the system. A model which assumed either zero or first order kinetics was devised to describe the nitrogen transformations of sludge-soil systems. The model was usually accurate in predicting the amount of ammonia, nitrate, nitrite, and organic nitrogen in the system and their rate of production. It was suggested that denitrification might be an important pathway of nitrogen transformation in sewage sludge-soil systems. (Geiger-FRC)
W81-02838

ATMOSPHERIC EMISSIONS OF ELEMENTS ON PARTICLES FROM THE PARKWAY SEWAGE-SLUDGE INCINERATOR,
Maryland Univ., College Park. Dept. of Chemistry.
R. R. Greenberg, W. H. Zoller, and G. E. Gordon.
Environmental Science and Technology, Vol 15, No 1, p 64-70, January, 1981. 1 Fig, 8 Tab, 26 Ref.

Descriptors: *Incineration, *Sludge disposal, *Ultimate disposal, Air pollution, Path of pollutants, Burning, Disposal, Waste water treatment, Metals, Heavy metals, Mercury, Lead, Pollutant identification, Public health, Parkway Waste Water Treatment Plant, Maryland.

Incineration of sewage sludge at the rate of 600 kg per hour at the Parkway Waste Water Treatment Plant, Laurel, Maryland, produced particulate emissions as follows (in grams per day): Hg 50, Pb 2, Na 8.2, Mg 4.8, Ca 6.5, Ba 7.3, Al 16, Ti 1.7, Cl 2, Fe 37, Zn 1.5. Other elements found in quantities less than 1 gram per day were Br, V, Cr, Mn, Co, Sc, Cu, Se, Ag, Cd, In, Sb, Ce, Eu, Yb, and Ta. The ash that escaped the scrubber system was less than 1% of the total 180 kg of ash produced from burning 600 kg sludge. The major point of the study was to determine if emissions from sewage sludge incinerators posed a threat to the community. Compared with emissions from coal-fired power plants, autos burning leaded gas, and municipal refuse incinerators, the emissions of Se, Sb, H_g, and Pb from sludge burning were minimal, and thus were considered no serious hazard to local residents. The most significant exposure was Hg at 50 g per day, for which airborne concentrations at ground level were slightly higher than ambient. (Cassar-FRC)
W81-02855

WASTEWATER EFFLUENTS FROM A TANNERY: THEIR EFFECTS ON SOIL AND VEGETATION IN PAKISTAN,
University of the Punjab., Lahore (Pakistan). Dept. of Botany.
For primary bibliographic entry see Field 3C.
W81-02897

5F. Water Treatment and Quality Alteration

FRANKLAW WATER TREATMENT WORKS.
Effluent and Water Treatment Journal, Vol 20, No 11, p 558-559, 561, November, 1980.

Descriptors: *Water treatment, *Water purification, Filters, Clarifiers, Sludge, Effluents, Water quality control, Water pollution treatment, Water pollution sources, Franklaw, United Kingdom.

The Franklaw Water Treatment Works operation is described. Raw water is taken from the River Wyre at the Garstang pumping station and transferred to the Franklaw treatment works via a 1400 mm steel main. The delivery main divides into three separate 800 mm mains at the works, each of which is equipped with a flow measuring Venturi and remote-operated flow control valves. The plant is designed to be under automatic control, being operated from a control room with a minimum of personnel involved. Strict water economy is enforced. The plant has been designed so that the flow can be adjusted to between 285 and 20 million liters per day and can be started up in half an hour to give drinkable water. The method of flocculation/clarification in the Degremont Superpulsator, a high speed clarifier, is described. The function of the Superpulsator is to allow the hydroxide flocs to separate from the water being treated. Clarification can simply be achieved by static tanks which operate on a batch principle. The flocculated water enters the tank and stands for a time long enough for the floc to settle out at the bottom of the tank as a sludge. The sludge blanket of a depth of approximately 3 m is controlled by sludge hoppers which are effectively troughs, the top edge of the trough being at the desired level of the blanket. There is a natural overflow of sludge into these troughs, where it is allowed to concentrate in order to reduce its volume prior to discharge. (Baker-FRC)
W81-02898

5G. Water Quality Control

GEOCHEMISTRY OF FLUORIDE IN THE BLACK CREEK AQUIFER SYSTEM OF HORRY AND GEORGETOWN COUNTIES, SOUTH CAROLINA--AND ITS PHYSIOLOGICAL IMPLICATIONS,
Geological Survey, Columbia, SC. Water Resources Div.
A. L. Zack.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.50. Geological Survey Water-Supply Paper 2067, 1980. 40 p, 11 Fig, 1 Plate, 2 Tab, 24 Ref.

Descriptors: *Geochemistry, *Fluorides, *Groundwater, *Water quality, *South Carolina, Aquifer characteristics, Water wells, Chemical analysis, Mineralogy, Horry County(SC), Georgetown County(SC).

High concentrations of fluoride in groundwater supplies in certain areas of Horry and Georgetown Counties, S.C., have been the cause of dental fluorosis (tooth mottling) among persons who have lived in these areas and have ingested the water as children. Geochemical evidence and laboratory experiments demonstrate that fluorapatite in the form of fossil shark teeth is the source of fluoride, and that the fluoride ions are liberated to the groundwater system through anion exchange, rather than by dissolution. Calcite-cemented quartz sand in the upper third of the Black Creek Formation of Late Cretaceous age contains the fossil shark teeth. As groundwater progresses downdip, the calcite matrix dissolves and hydrolyzes, releasing bicarbonate, hydroxyl, and calcium ions. The calcium ions are immediately exchanged for sodium ions adsorbed on sodium-rich clays, and the bicarbonate ions accumulate. As the shark teeth are exposed, the hydroxyl ions in solution exchange with fluoride ions on fluorapatite surfaces. Experiments using fossil shark teeth show that sodium chloride in solution inhibits the rate of exchange of fluoride ions from tooth surfaces for hydroxyl ions in solution. The amount of fluoride removed from water and exchanged for hydroxyl ions in the presence of pure hydroxylapatite (hog teeth) was greater in saline water than in freshwater. (USGS)
W81-02677

WATER-RESOURCES INVESTIGATIONS, COLLIER COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. Klein.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $4.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File

Report 80-1207, 1980. 29 p, 15 Fig, 17 Ref.

Descriptors: *Water resources, *Investigations, *Groundwater availability, *Water quality, *Florida, Aquifer characteristics, Water levels, Water table, Saline water intrusion, Canals, Drainage, Data collections, Sites, *Collier County(FL), Southwest Florida, Floridan aquifer.

Early water-resources investigations in Collier County, Fla., were related to saltwater intrusion in Naples. With the advent of canal drainage and land reclamation farther inland, investigations were directed at effects of canals on water resources and the environment. High on the list of investigative needs are: (1) areal and vertical delineation of the shallow aquifer, the prime source of freshwater; (2) delineation of areas of poor quality ground water and the sources of the poor quality; (3) establishment of network of hydrologic data stations; and (4) determination of the relation between canals and the shallow aquifer. (USGS)
W81-02699

WATER QUALITY OF A RESERVOIR USED FOR RECLAIMED WATER STORAGE,
California Univ., Irvine. School of Engineering.
P. S. Dixon, and J. Scherfig.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-197618, Price codes: A04 in paper copy, A01 in microfiche. California Water Resources Center, University of California, Davis Technical Completion Report, April, 1980, 64 p, 3 Fig, 17 Tab. (California Water Resources Center Project UCAL-WRC-W-551). OWRT-A-070-CAL(1).

Descriptors: *Water quality, *Reclaimed water, *Reservoirs, Algal growth, Reservoir storage, Dissolved solids, Suspended solids, Chemicals, Reservoir operation, California.

The water quality of two reservoirs receiving differing amounts of reclaimed water is compared with a neighbouring reservoir receiving none. Monthly sampling of chemical parameters is presented, together with analyses of dissolved and suspended solids (the latter fractionated into sized components). Quantitative estimation of algal populations presented little significant information although measurement of algal growth potential, using the Selenastrum capricornutum 'bottle test', gave data of considerable importance for reservoir management. (Snyder-California)
W81-02712

AN APPROACH FOR ASSESSING THE WATER QUALITY SIGNIFICANCE OF CHEMICAL CONTAMINANTS IN URBAN LAKES,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 5C.
W81-02749

A WATER QUALITY PLANNING METHODOLOGY FOR URBAN AREAS,
CH2M/Hill, Reston, VA.
For primary bibliographic entry see Field 6B.
W81-02771

CHEMICAL TREATMENTS OF SOIL TO DECREASE RADIOSTRONTIUM LEACHABILITY,
Oak Ridge National Lab., TN. Environmental Science Div.
B. P. Spalding.
Journal of Environmental Quality, Vol 10, No 1, p 42-46, January-March, 1981. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Nuclear wastes, *Leaching, Path of pollutants, Groundwater pollution, Water quality control, Anions, Cations, Laboratory tests, Radioactive wastes, Water pollution, Radioactive waste disposal, Calcium carbonate, Water pollution control.

The shallow land burial of radioactive wastes often results in the leaching of radiostrontium into soils and groundwaters. A study was conducted by the Oak Ridge National Laboratory (ORNL) to investigate methods of arresting the leaching of 90Sr in situ. Three soils were collected from the solid waste disposal area at ORNL and were labeled with 85Sr and placed into small columns. The soil columns were percolated with equal amounts of sodium salt solutions of hydroxide, fluoride, carbonate, phosphate, silicate and aluminate before leaching with 0.1 N CaCl2. Only 30-35% of the 85Sr could be leached from two soils which were high in indigenous exchangeable calcium cations. The 85Sr was presumably precipitated along with the nascent CaCO3 produced during treatment. However, over 98% of the 85Sr was leached from all of the untreated soils. In general, less 85Sr was fixed by the other anions than by the carbonate treatment. These findings suggest that sodium carbonate may be a potential immobilizer of 90Sr in situ in soils contaminated by nuclear wastes. (Geiger-FRC)
W81-02826

THE POLITICS OF WATER POLLUTION CONTROL: A CASE STUDY OF THE FORMATION OF THE CANADA WATER ACT, PART I: COMPREHENSIVE WATER RESOURCE MANAGEMENT: PART II: NUTRIENT CONTROL,
King Alfred's Coll., Winchester (England).
For primary bibliographic entry see Field 6E.
W81-02836

FUNGAL PATHOGEN OF CLADOPHORA GLOMERATA (CHLOROPHYTA),
Academy of Natural Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
T. L. Bott, and K. Rogenmuser.
Applied and Environmental Microbiology, Vol 40, No 5, p 977-980, November, 1980. 2 Fig, 28 Ref.

Descriptors: *Eutrophication, *Algal control, Laboratory tests, Aquatic fungi, Biocontrol, Pathogenic fungi, Lakes, Cladophora.

The pathogenic activity of Acremonium kiliense (Fungi Imperfecti) against Cladophora glomerata was investigated in laboratory tests and under more natural conditions. In the laboratory tests, fugal pathogenicity was demonstrated most clearly by cell condition and chlorophyll alpha concentration. More than 85% of the Cladophora cells were bleached at the highest inoculum level when conidia were added. In two microcosm experiments, after one week the C. glomerata in the inoculated flowing-water was almost completely chlorotic. In the controls, few cells were chlorotic. Further research with biological agents and algae capable of causing problem growths may yield new control procedures. During the course of these studies, the virulence of A. kiliense decreased. Thus variation in tolerance or adaptation of the target organism must be investigated. (Small-FRC)
W81-02846

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

USING CHANNEL GEOMETRY TO ESTIMATE FLOOD FLOWS AT UNGAGED SITES IN IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
W. A. Harenberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-153736, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-32, August 1980. 39 p, 6 Fig, 1 Plate, 3 Tab, 31 Ref.

Descriptors: *Channel morphology, *Estimating equations, *Flood flow, *Flood frequency, *Idaho, River basins, Analytical techniques, Flood forecasting, Flood discharge, Peak discharge, Flow characteristics, Basin characteristics, Channel geometry, Bankfull discharge, Bankfull width.

Measurements at bankfull stage were made at 136 sites in Idaho to determine whether predictions of flood discharge using channel-geometry characteristics are as good as or better than predictions using basin characteristics. These measurements are used to determine the variables of bankfull width, area, depth, and velocity. These variables are combined with basin characteristics for the sites, and multiple-regression techniques are used to select the best combination of variables to estimate the 10-year flood. To achieve the lowest standard error of estimate, the data set is divided into segments based on percentage of forest cover. Generally, discharge estimates obtained from equations using channel characteristics have smaller standard errors than those using basin characteristics. (USGS)
W81-02679

COMPUTER ROUTINES FOR PROBABILITY DISTRIBUTIONS, RANDOM NUMBERS, AND RELATED FUNCTIONS,
Geological Survey, Reston, VA. Water Resources Div.
W. Kirby.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $8.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-448, 1980. 61 p, 16 Ref.

Descriptors: *Computer programs, *Statistics, *Probability distribution, Data processing, Hydrologic data, Mathematical studies.

Use of previously codes and tested subroutines simplifies and speeds up program development and testing. This report presents routines that can be used to calculate various probability distributions and other functions of importance in statistical hydrology. The routines are designed as general-purpose Fortran subroutines and functions to be called from user-written main programs. The probability distributions provided include the beta, chi-square, gamma, Gaussian (normal), Pearson Type III (tables and approximation), and Weibull. Also provided are the distributions of the Grubbs-Beck outlier test, Kolmogorov's and Smirnov's D, Student's t, noncentral t (approximate), and Snedecor F tests. Other mathematical functions include the Bessel function I (subzero), gamma and log-gamma functions, error functions and exponential integral. Auxiliary services include sorting and printer plotting. Random number generators for uniform and normal numbers are provided and may be used with some of the above routines to generate numbers from other distributions. (USGS)
W81-02693

GROUNDWATER HYDROLOGY OF JAMES CITY COUNTY, VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-02695

STUDY PLAN FOR THE REGIONAL AQUIFER-SYSTEM ANALYSIS OF ALLUVIAL BASINS IN SOUTH-CENTRAL ARIZONA AND ADJACENT STATES,
Geological Survey, Tucson, AZ. Water Resources Div.
T. W. Anderson.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $3.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-1197, October, 1980. 22 p, 5 Fig, 27 Ref.

Descriptors: *Project planning, *Aquifer management, *Regional analysis, *Hydrogeology, Aquifer characteristics, Surface groundwater relationships, Groundwater availability, Drawdown, Groundwater movement, Water utilization, Water supply, Water quality, Model studies, Data collections, Water resources development, Water management(Applied), Arizona, California, Nevada, New Mexico, *Southwest U.S.

The U.S. Geological Survey has started a 4-year study of the alluvial basins in south-central Arizona and parts of California, Nevada, and New

Mexico to describe the hydrologic setting, available groundwater resources, and effects of historical development on the groundwater system. To aid in the study, mathematical models of selected basins will be developed for appraising local and regional flow systems. Major components necessary to accomplish the study objectives include the accumulation of existing data on groundwater quantity and quality, entering the data into a computer file, identification of data deficiencies, and development of a program to remedy the deficiencies by collection of additional data. The approach to the study will be to develop and calibrate models of selected basins for which sufficient data exist and to develop interpretation-transfer techniques whereby general predevelopment and postdevelopment conceptual models of the hydrologic system in other basins may be synthesized. The end result of the project will be a better definition of the hydrologic parameters and a better understanding of the workings of the hydrologic system. The models can be used to study the effects of management alternatives and water-resources development on the system. (USGS)
W81-02701

DEVELOPMENT OF A STREAMFLOW FORECASTING PROCEDURE FOR INTERMOUNTAIN BASINS,
Montana State Univ., Bozeman. Dept. of Civil Engineering.
A. B. Cunningham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198442. Completion Report, December, 1980. Montana Water Resources Research Center, Montana State University Report No 113. 26 p, 13 Fig, 7 Ref. OWRT A-116-MONT(1), 14-34-0001-9028.

Descriptors: *Streamflow forecasting, *Snowmelt, *Runoff forecasting, *Computer models, *Basins, Catchment areas, Forecasting, Streamflow, Flow, Overland flow, Thaw, Snowpack, Snow cover, Predictions, Computer programs, Model studies, Montana.

This research study sought to develop and test a method for forecasting the magnitude and profile of streamflow hydrographs occurring primarily as result of snowmelt runoff. Hence, the scope of the desired forecasting procedure was narrow by comparison with National Weather Service forecasting procedures. The study should be viewed as a contribution toward systematic water resources management in that it functions in supplying hydrologic data critical to operation of various types of surface water retention/regulation facilities. Properly calibrated, the developed procedure allows for forecasting daily streamflows over a 5-7 day forecast period in regions for which hydrologic data are limited. Basic data needed include: study-site daily streamflow values; mean daily temperatures; maximum snowpack water equivalent at onset of melt season. A developed computer-graphics-oriented algorithm was used to test the methodology, but the few calculations needed during routine forecasting can be handled without a computer, if desired. Three southwest Montana drainage basins were analyzed during the Spring 1980 runoff period. Favorable results were obtained concerning the adequacy of the streamflow forecasting procedure. (Zielinski-IPA)
W81-02726

CONTROL OF THE WATER RESOURCES OF THE AZOV SEA USING THE 'AZOV PROBLEM' FAMILY OF SIMULATION SYSTEMS,
Rostov-on-Don State Univ. (USSR). Inst. of Mechanics and Applied Mathematics.
A. B. Gorstko, F. A. Surkov, L. V. Epshteyn, and A. A. Matveyev.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, Aug 27-30, 79, Bloomfield Hills, MI. EPA Report 600/9-80-033, Jul 80. p 252-260, 2 Fig, 7 Ref.

Descriptors: *Water resources development, *Simulation, *Regional development, Water management, Water quality, Water conservation, Industrial water, Water use, Agriculture, Fisheries, Powerplants, Regional planning, Ecological effects, Information systems, Azov Sea basin, *Russia.

A well-developed industrial and agrarian complex has grown up in the Azov Sea drainage basin (USSR). Significant volumes of fresh water, which must be of high quality, are necessary for normal functioning and further development of industry, agriculture, power engineering, fishing, water transport, and normal living conditions. However, the region is poor in fresh water resources. The range of problems related to the use of water resources in the Azov Sea basin, conservation or conscientious reconstruction of the ecosystem of the Azov Sea, and the development of macroregional programs of supplementing the continental runoff in the basin is referred to as the Azov problem. Solution of the Azov problem requires systematic development of a multitude of versions of regional ecologic policies and water management strategies in the basin, and evaluation of the probable effects of these versions in combination with macroregional projects. The basic principle of organization of all scientific plans and plan development on the Azov problem should be the idea of the man-machine system. This should include structural subsystems, decision making personnel at various levels; experts on the Azov problem as a whole, and experts on its individual aspects; plan developers; 'Azov problem' simulation systems; and information bank; and persons who plan and conduct experiments with the simulation systems. (Moore-SRC)
W81-02743

ADEQUACY AND ECONOMICS OF WATER SUPPLY IN NORTHEASTERN ILLINOIS, 1985-2010,
Illinois State Water Survey, Urbana.
K. P. Singh, and J. R. Adams.
Illinois Institute of Natural Resources, Report of Investigation 97, 1980. 205 p, 47 Fig, 68 Tab, 39 Ref, 2 Append.

Descriptors: *Economics, *Aquifers, *Illinois, *Model studies, *Groundwater, Subsurface water, Radioactivity, Systems analysis, Value engineering, Water conveyance, Water costs, Water allocation(Policy), Water management(Applied), Water supply, Water treatment.

Plans were developed for optimal use of available groundwater and surface water resources for adequate and dependable water supply to all towns in Cook, DuPage, Kane, Lake, McHenry, and Will Counties. An efficient water-demand model, based on a town's population and industrial employment, was used for future demand projections. The potential yield of sand and gravel and Silurian dolomite aquifers was investigated. Cost functions were developed in terms of July 1980 dollars for wells, pumps, water conveyance system components, reservoirs, and treatment plants. Out of a total of 273 towns, 96 are presently served with lake water either directly or from Chicago. The groundwater supply from shallow aquifers is adequate for 85 towns. Thus, 92 towns need other sources of water if the safe yield of the deep sandstone aquifer is not to be exceeded. Six optimal regional systems to meet these demands were developed. The Fox Valley system considers conjunctive use of groundwater, as well as direct supply from Lake Michigan. The Kankakee River system considers water withdrawal from the river near Wilmington. The other four systems---Lake County, Northwestern Cook County, DuPage County, and Southern Cook County---obtain water from the lake directly or from Chicago. With the proposed individual groundwater and regional surface water systems, there is ample water for all towns in northeastern Illinois to meet their water demands for the next 30 or more years, without mining of the deep aquifer. (Author's abstract)
W81-02796

DEVELOPMENT OF A GROUNDWATER MODEL FOR THE HENRY'S FORK AND RIGBY FAN AREAS, UPPER SNAKE RIVER BASIN, IDAHO,
Idaho Univ., Moscow. Water and Energy Resources Research Inst.
J. Wytzes.
Research Technical Completion Report, Submitted to Idaho Department of Water Resources, August, 1980. 205 p, 24 Fig, 19 Tab, 115 Ref, 5 Append.

Descriptors: *Idaho, *River basins, *Water table fluctuations, *Groundwater basins, *Simulation analysis, Model studies, Streamflow, Permeability coefficient, Evapotranspiration, Storage coefficient, Geohydrologic units, Specific yield, Diversion losses, Snake River basin.

The study describes the essential aspects of a groundwater flow system in the subject area. It provides for a water resources planning and management tool in the form of a digital simulation model that can be used for efficient administration and management of local groundwater resources. A finite difference model, based upon the alternating direction technique, is used to simulate the basic mathematical equations governing groundwater flow in an isotropic, homogeneous water table aquifer. The model includes an iterative calibration procedure to adjust initial estimates of geohydrologic parameters, such as hydraulic conductivity, leakance factors, and storage coefficients in such a way that the deviations between simulated and measured 'historic' water levels are within a predetermined range. Historic water tables were measured during a selected calibration period from May 1977 through April 1978. Water budget components, such as irrigation diversions, stream flows, water conveyance system losses and climatological data were compiled in the input routine. The resulting model provides a reliable tool for research, planning and administrative purposes. (Garrison-Omniplan)
W81-02804

6B. Evaluation Process

SUMMARY OF HYDROLOGIC DATA FOR THE EAST EVERGLADES, DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02697

A WATER QUALITY PLANNING METHODOLOGY FOR URBAN AREAS,
CH2M/Hill, Reston, VA.
F. W. Ellis, and R. L. Wycoff.
In: Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies, Proceedings of the National Conference, Orlando, Florida, November 26-28, 1979, Environmental Protection Agency Report EPA 600/9-80-056, December 1980. p 590-617, 11 Fig, 7 Ref. 68-01-3993.

Descriptors: *Cost-benefit analysis, *Urban runoff, *Water quality management, *Cost analysis, Evaluation, Water quality control, Water pollution sources, Water pollution control, Hydrology, Sewer systems, Planning, Case studies, Philadelphia, Des Moines.

Because of the very large sums of money required to improve urban water quality, and the difficulty of raising money for such projects it is necessary that the projects demonstrate perceptible improvements in water quality, are required for the protection of the intended beneficial use of the receiving water, and make use of the most cost-effective pollution control methods. A two-phase approach has been developed to assess water quality problems and potential solutions. Phase I determines the beneficial uses of the receiving water; establishes water quality goals; determines the nature, sources, and extent of water quality problems; estimates the degree of pollution abatement required; determines the most cost-effective mix of control alternatives; and provides for evaluation of the project. If Phase I indicates that there are water quality problems that can be corrected with affordable solutions, the detailed analysis of Phase II is required. This phase considers the area's hydrol-

ogy, combined and separate sewer system hydraulics, nonpoint and point source pollutants, and the receiving water quality response. Case studies for Philadelphia, Pennsylvania, and Des Moines, Iowa, are used to illustrate the analyses and the site-specific nature of the water quality planning process. (Brambley-SRC)
W81-02771

SMALL SCALE HYDROPOWER DEVELOPMENT IN ILLINOIS: AN IMPLEMENTATION MANUAL,
WAPORA, Inc., Chicago, IL.
G. Lindsey.
Illinois Institute of Natural Resources Document No 80/30, December 1980. 180 p, 13 Fig, 7 Tab, 121 Ref, 3 Append.

Descriptors: *Illinois, *Hydroelectric plants, *Energy sources, *Environmental surveys, Feasibility studies, Licensing, Project benefits, Economic aspects, Hydraulic engineering, Dam effects, Dam construction, Permits, Reservoir siting.

Renewed interest in small-scale hydropower is growing rapidly as an alternative to the use of non-renewable fuels such as coal, uranium, oil, and gas. Preliminary studies in Illinois indicate that the development of a minimum of 57 to 130 megawatts of renewable, small-scale hydroelectric generating capacity is, or soon will be, economically feasible at existing dam sites. This implementation manual, written for readers with non-technical backgrounds, is intended to assist potential developers of existing dam sites, who may be newly acquainted with hydropower, in the implementation of small-scale hydropower projects. The manual is divided into nine sections: (1) a user's guide; (2) a conceptual description of a small-scale hydropower plant; (3) a summary of recent Federal and State programs designed to encourage small-scale hydropower development; (4) a review of the significance and potential of small-scale hydropower resources in Illinois; (5) techniques for making preliminary assessments of site potential; (6) regulatory considerations; (7) environmental considerations; (8) potential sources of financing; and (9) considerations for implementation. (Garrison-Ominplan)
W81-02788

PHASE I REPORT - INVENTORY OF POTENTIAL SMALL-SCALE HYDROPOWER SITES IN ILLINOIS AND SELECTION OF PROJECTS EXHIBITING POTENTIAL FOR DEVELOPMENT,
WAPORA, Inc., Chicago, IL.
G. Lindsey, G. M. Kelly, and D. Sweeney.
Illinois Institute of Natural Resources Document No 81/03, January, 1981. 29 p, 1 Fig, 5 Tab, 40 Ref, 2 Append.

Descriptors: *Illinois, *Hydroelectric power, *Hydroelectric plants, *Electric power production, *Feasibility studies, Power plants, Flow duration, Hydraulics, Damsites, Rivers, Water resources development, River basin development, Flow characteristics.

Interest in developing small-scale hydroelectric power has increased recently because of rapidly rising fossil and nuclear fuels costs, and constraints on sitings of new power plants. This report lists 114 potential small-scale sites, with existing dams, in Illinois. Fifteen sites exhibited the greatest economic potential for hydroelectric development. The combined generating capacity for the 57 sites for which head and flow data are available is estimated to be 176 MW; their mean capacity is 3.19 MW. Twenty-five sites have a potential capacity of more than 350 KW, while 21 sites have a potential capacity of less than 100 KW. Storage pools, which can be used to generate peak load power, exist at only 35 of the sites. Descriptions of seven hydropower feasibility or development projects now underway are included, as well as a narrative on the historical perspective of water power in Illinois. This report is the first of a three-part project entitled 'Low Head Hydroelectric Generation Potential in Illinois.' Phase II and Phase III report on the potential sites identified here, and describe procedures for implementation. (Garrison-Omniplan)
W81-02789

PHASE II REPORT - PRELIMINARY INVESTIGATION OF SMALL-SCALE HYDROPOWER POTENTIAL AT FIVE SITES IN ILLINOIS,
WAPORA, Inc., Chicago, IL.
G. Lindsey, and D. Sweeney.
Illinois Institute of Natural Resources Document No 81/05, January, 1981. 111 p, 33 Fig, 2 Tab, 50 Ref, 60 Append.

Descriptors: *Illinois, *Hydroelectric power, *Feasibility studies, Evaluation, Hydrologic data collections, *Economic aspects, Cost analysis, Hydroelectric plants, Electric power production, Flow duration, Hydraulics, Damsites, Rivers, Water resource development.

This is the second phase of a three-part study entitled 'Low-Head Hydroelectric Generation Potential in Illinois.' The report presents preliminary engineering, cost/benefit, and environmental analyses of the hydropower potential at five sites selected from the 114 sites identified in Phase I as having potential for hydropower production. The 114 original sites were screened to select those with the greatest relative potential for economic development. Sites with an estimated capacity of less than 350 kw were eliminated, as were sites with an average annual flow of less than 100 cubic feet/second. The engineering analyses on the five selected sites include descriptions of the existing structures and potential development alternatives at each site, along with conceptual design sketches. The five sites selected were the Oregon Dam on the Rock River in Oregon, the Upper-Sterling Dam on the Rock River at Sterling-Rock Falls, the Wilmington Dam on the Kankakee River at Wilmington, the Kankakee Dam on the Kankakee River at Kankakee, and the Elgin Dam on Fox River at Elgin. The break-even revenue requirement for each site is presented. Phase III will consist of a how-to manual to guide the implementation of additional hydropower plants in Illinois. (Garrison-Omniplan)
W81-02790

ASSESSMENT OF PUBLIC GROUNDWATER SUPPLIES IN ILLINOIS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 4B.
W81-02794

ADEQUACY AND ECONOMICS OF WATER SUPPLY IN NORTHEASTERN ILLINOIS: PROPOSED GROUNDWATER AND REGIONAL SURFACE WATER SYSTEMS, 1985-2010,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 4B.
W81-02795

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE LONG RUN PROFITABILITY OF WESTERN IRRIGATED AGRICULTURE: AN IN-DEPTH ANALYSIS,
Arizona Univ., Tucson. Coll. of Agriculture.
Y. Goldschmidt, and W. E. Martin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-193948, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, 1980. 57 p, 1 Fig, 13 Tab, 22 Ref. OWRT-B-080-ARIZ(5), 14-34-0001-0203.

Descriptors: *Economic evaluation, *Profit, *Irrigation practices, Income distribution, Agriculture, Farm management, Cost analysis, Economic aspects, Irrigation, Irrigable land, Income, Farming, Farms, Costs, Estimated costs, Accounting, Budgeting, Investment, Mathematical studies, Numerical analysis, Economic prediction, Economic yield.

The purpose of this study focused on the development of consistent conceptual procedures for analyzing profitability of irrigated farms during inflation, for developing cost budgets of such farms and for evaluating investment in water projects. Models of the organizations, costs, and returns of representative farms developed by agricultural economists for most western irrigated areas have generally shown little or no return to long-run capital investment (including irrigation development); yet it is observed that farmers do remain in business, make capital investments, and favor irrigation development. It was concluded that standard economic budgets do not give an accurate picture of reality. Three major variables are normally excluded from standard budgets: (1) long-run wealth development (versus short-run net income); (2) effects of income tax laws on short-run income and long-run wealth; and (3) the budget-distorting effects of inflation. Procedures for incorporating these three variables into budget analysis were developed and shown. The exclusion of each of these variables causes underestimation both of the income and wealth position of farmers. (Zielinski-IPA)
W81-02655

THE SEARCH FOR EQUITY AND EFFICIENCY IN THE PRICING OF A PUBLIC SERVICE: URBAN WATER,
Pennsylvania Univ., Philadelphia.
S. L. Feldman, J. Breese, and R. Obeiter.
Economic Geography, Vol 57, No 1, p 78-93, 1981. 2 Fig, 2 Tab, 23 Ref.

Descriptors: *Pricing, *Water rates, Marginal costs, Utilities, Unit costs, Economics, Costs, Water distribution(Applied), *Washington, D. C., Cost-benefit analysis, *Municipal water.

Practical ways of implementing the marginal cost pricing scheme are presented for urban water. Prices are based upon incremental costs for each rating period, the peak users bearing all capacity charges. As applied to the Washington Suburban Sanitary Commission, Washington, D. C., use of marginal cost pricing would produce an annual welfare gain of $1.85 million, justifying implementation of the plan requiring expensive demand meters. (Cassar-FRC)
W81-02831

6D. Water Demand

WATER-RESOURCES INVESTIGATIONS, COLLIER COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5G.
W81-02699

APPRAISAL OF GROUND-WATER RESOUCES IN THE SAN ANTONIO CREEK VALLEY, SANTA BARBARA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
C. B. Hutchinson.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $7.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-750 (WRI), August 1980. 48 p, 14 Fig, 5 Tab, 16 Ref.

Descriptors: *Groundwater resources, *Water yield, *Water utilization, *Water demand, *California, Overdraft, Hydrogeology, Aquifer characteristics, Water levels, Groundwater movement, Salinity, Water quality, Chemical analysis, Monitoring, Sites, Aerial photography, San Antonio Creek valley(CA), Santa Barbara County(CA), Barca Slough(CA).

A nearly threefold increase in demand for water in the 154-square-mile San Antonio Creek valley in California during the period 1958-77 has increased the potential for overdraft on the ground-water basin. The hydrologic budget for this period showed a perennial yield of about 9,800 acre-feet per year and an annual ground-water discharge of about 11,400 acre-feet per year, comprising net

pumpage of 7,100 acre-feet, phreatophyte evapotranspiration of 3,000 acre-feet, and base streamflow of 1,300 acre-feet. The base flow in San Antonio Creek could diminish to zero when net pumpage reaches 13,500 acre-feet per year. The environmentally sensitive marshland area of Barka Slough may then become stressed as water normally lost through evapotranspiration is captured by pumpage. The aquifer consists of alluvial valley fill that ranges in thickness from 0 to 3,500 feet. Ground water moves seaward from recharge areas along mountain fronts to a consolidated rock barrier about 5 miles east of the Pacific coast. Upwelling of ground water just east of the barrier has resulted in the 550-acre Barka Slough. Transmissivity of the aquifer ranges from 2,600 to 34,000 feet squared per day, with the lowest values occurring in the central part of the valley where the aquifer is thickest but probably finer grained. The salinity problems are increasing in the agricultural parts of the valley, which is east of the barrier. West of the barrier, stream and ground-water quality is poor, owing to seepage of saline water from the marine shale that underlies the area at shallow depths. A proposed basinwide monitoring program includes 17 water-level sites, 12 water-quality sampling sites, 3 streamflow measuring sites, and periodic infrared aerial photography of Barka Slough. A computer model of the ground-water flow system could be developed to assess the impact of various water-management alternatives. (USGS)
W81-02700

ADEQUACY AND ECONOMICS OF WATER SUPPLY IN NORTHEASTERN ILLINOIS, 1985-2010,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 6A.
W81-02796

6E. Water Law and Institutions

PUBLIC ATTITUDES OF NEBRASKANS TOWARD WATER POLICY,
Nebraska Univ.-Lincoln, Dept. of Political Science.
S. Welch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198418. Price codes: A02 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska Completion Report, March, 1981. 12 p, 7 Tab, 15 Ref. OWRT-A-058-NEB(1), 14-34-0001-9029.

Descriptors: *Nebraska, *Water policy, *Public opinion, *Policy making, Attitudes, Evaluation, Benefits, Political aspects, Administrative decisions, Public policy, Water law, Legal aspects, Social participation, Public participation, Political constraints, Water use, Water use efficiency, Water shortage, Administrative regulations, Regulations, Water deficit.

The project purposes were to ascertain the extent of public knowledge concerning Nebraska water policy and existing institutions dealing with Nebraska water policy (Natural Resource Districts (NRD'S)); to obtain detailed information on Nebraskan attitudes concerning suggested alternative groundwater policies; to identify groups of Nebraskans in favor of and opposed to several different types of water policy; and to communicate public setiments of this important issue to Nebraska State policy makers. The project used 1977-1980 collected data from the Nebraska Annual Social Indicators Survey (NASIS) by the Bureau of Sociological Research (at University of Nebraska-Lincoln). This is a Statewide survey of 1800 adult Nebraskans. It was concluded that: (1) Nebraskans support water usage control in water shortages, covering agriculture, business, industry, and household use; (2) government regulation, rather than higher prices or taxation, is favored for water usage control; and (3) most Nebraskans are unfamiliar with NRD's and have not participated in NRD elections. The project findings were forwarded to local and State water policy makers. (Zielinski-IPA)
W81-02725

CALIFORNIA'S WATER CONFLICT: NORTH VS SOUTH,
V. Kayfetz.
Ambio, Vol 9, No 6, p 319-320, 1980. 1 Fig.

Descriptors: *California, *Legislation, *Peripheral Canal, *Water rights, Water transfer, Proposition 8, Canals, Legal aspects, State Water Project, California Aqueduct, Deltas, Aqueducts, Environmental effects, Aquatic life, Water law, Water policy.

Opposition to the construction of the Peripheral Canal in the delta area 50 miles east of San Francisco is aimed at repealing the California Senate Bill 200, which authorizes a 20-year $5 billion expansion of the State Water Project, designed to move more northern water to the southern part of the state. Environmentalists are afraid that the 1000 sq mile delta will become unusable for wildlife and agriculture. Salinity problems may occur if insufficient water is allowed to flow to the Pacific. Supporters of the Canal say that water release into the eastern delta will prevent saline intrusion and restore aquatic life. Although Proposition 8 was designed to calm the northerner's fears, many suspect that the few remaining wild rivers may be tapped for consumption in the south. (Cassar-FRC)
W81-02809

THE POLITICS OF WATER POLLUTION CONTROL: A CASE STUDY OF THE FORMATION OF THE CANADA WATER ACT, PART I: COMPREHENSIVE WATER RESOURCE MANAGEMENT: PART II: NUTRIENT CONTROL,
King Alfred's Coll., Winchester (England).
J. W. Parlour.
Journal of Environmental Management, Vol 12, No 1, p 31-64, January, 1981. 1 Fig, 87 Ref.

Descriptors: *Water policy, *Canada Water Act, *Phosphates, Detergents, Nutrients, Legislation, Water law, Political aspects, Nitrilotriacetic acid, Legal aspects, Water resources, Governments, Social aspects, Water quality control, Regulations, Economics, Cost-benefit analysis, Environmental effects, Planning, Political constraints, *Water management, *Nutrient removal.

The 'inside' political aspects of the formation of the Canada Water Act are presented as a complement to earlier studies on the subject of sociopolitical responses to water pollution problems in Canada, 1945-1972. Part I of the paper concerns the formation of the Canada Water Act, Parts I and II, dealing with Comprehensive Water Resources Management and Water Quality Management, respectively. Part II of the paper concerns nutrient control, which is Part III of the Act. After years of preliminary development, during which policy changed from emphasis on water resources management alone to a concern for both water resources and water quality, the Canada Water Act was passed in 1970. Nutrient control was added later as a response to escalation of mass media attention and public concern. A step-by-step description of policies regulating phosphates in detergents is described, as well as the debate on a phosphate substitute, nitrilotriacetic acid, whose long-term health effects are not known. The author states that government scientists promoted policy which complied with their own research findings on eutrophication and phosphate/nitrilotriacetic acid research and suppressed information disagreeing with their views. Although the scientific information was an important factor in formulating policy, final regualtions were set with main concern for public and manufacturer acceptance. The government attempts to weigh costs and benefits of alternative ideas were unreliable and did not sufficiently consider social and economic factors. (Cassar-FRC)
W81-02836

6F. Nonstructural Alternatives

ESTIMATING FLOOD DAMAGES IN THE STATE OF GEORGIA,
Georgia Inst. of Tech., Atlanta. Coll. of Architecture.
T. N. Debo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198343, Price codes: A11 in paper copy, A01 in microfiche. Completion Report, January, 1981. Environmental Resources Center, Georgia Institute of Technology Report ERC 01-81. 213 p, 18 Fig, 17 Tab, 22 Ref, 3 Append. OWRT-A-081-GA(1).

Descriptors: *Flood damage, *Flood date, *Georgia, *Computer models, *Economic impact, Economic prediction, Drainage area, Damage, Floodproofing, Flood plain management, Floods, Floodwater, Flood frequency, Flooding, Model studies, Mathematical models, Model testing, Statistical models, Economic evaluation, Prediction.

This study sought to: document monetary Georgia flood damages; develop a computer model to estimate urban flood damages, for large/small areas throughout Georgia; develop urban flood estimation curves using the computer model, to estimate flood damages quickly for different flood plain developments; study flooding history in six selected case study urban areas and estimate existing and potential average annual expected area flood damages, using the estimation curves; and evaluate Georgia flood damage potential from the case studies and documented information. The economic computer model developed for the Columbus, Georgia, Storm Water Management Program was further refined for this study. Provided that sufficient data are available, the model can be used for estimating flood damages from any land use, using local stage-frequency data. There is very little reliable data documenting monetary damages related to different Georgia flood events; recommendations were developed to address this deficiency, which severely limits studies into flood damage aspects of storm water management. (Zielinski-IPA)
W81-02720

6G. Ecologic Impact Of Water Development

WATER QUALITY OF A RESERVOIR USED FOR RECLAIMED WATER STORAGE,
California Univ., Irvine. School of Engineering.
For primary bibliographic entry see Field 5G.
W81-02712

LONG-TERM CONSEQUENCES OF UPSTREAM IMPOUNDMENT,
G. E. Petts.
Environmental Conservation, Vol 7, No 4, p 325-332, Winter, 1980. 4 Fig, 31 Ref.

Descriptors: *Impoundments, *Dams, *Environmental effects, *Invertebrates, *Aquatic life, Upstream, Planning, Environmental effects, Channel morphology, Reservoirs, Erosion, Aquatic habitats, Fish, Construction, Flood control, Sedimentation, Deposition(Sediments), Rivers, Planning, Ecology.

The environmental consequences of dam and reservoir construction on a river system are considered in a framework consisting of first-, second-, and third-order impacts. The immediate and simultaneous effects of the activity (dam building) are first-order impacts, for example, reductions in peak flow, entrapment of sediment load, reduction in suspended sediment load, induced erosion immediately below the dam, and channel changes. These induce second-order impacts, changes in channels and invertebrate populations taking place over a longer period after construction--perhaps as long as 50 years. Channel cross-sectional reduction dominates morphological changes in impounded rivers--depth increase from erosion, depth decrease from sedimentation, width reduction from redistribution of the floodplain and channel boundary materials, and width reduction from sediment deposition. After initial changes in aquatic life during the second-order stage, further adjustments occur as part of a third-order impact. For example, accumulation of fine sediments in pools discourages growth of invertebrates and encourages establishment of rooted aquatic plants. These plants in turn can further affect channel morphology. Changes in

fish habitats, intimately associated with changes in channel width, depth, and sediment composition and in flora and fauna, may continue to occur for many years after the initial construction. Planners should not base environmental impact assessments on short-term effects alone, but must consider the complex interactions taking place over many years before a morphological and ecological equilibrium is reached. (Cassar-FRC)
W81-02835

POLAND LAUNCHES MAJOR PROGRAM TO RESTORE AND REGULATE COUNTRY'S LARGEST RIVER SYSTEM,
For primary bibliographic entry see Field 5D.
W81-02889

7. RESOURCES DATA

7A. Network Design

BASIC TRENDS IN THE STUDY OF HYDROCHEMICAL FIELDS AND THE STRUCTURE OF THEIR SPACE-TIME HETEROGENEITIES,
Gidrokhimicheskii Inst., Rostov-na-Donu (USSR).
V. L. Pavelko, B. M. Vladimirskiy, I. T. Gavrilov, and G. V. Tsytsarin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, August 27-30, 1979, Bloomfield Hills, MI. EPA Report 600/9-80-033, July, 1980. p 1-8, 1 Fig, 11 Ref.

Descriptors: *Water quality, *Data acquisition, *Research priorities, Pollutants, Automation, Hydrology, Model studies, Model testing, *Water chemistry.

Currently the basic task of hydrochemical research is the development of prognostic and functional models of water quality, which must correspond to the requirement sof operational evaluation and quality control. To obtain the necessary data with the minimum of cost requires estimation of the space and time study level of each component given the existing parameters of the observation system; finding the mean level of study; finding the variation in the level of study with the space-time scanning step; and redistribution of the equipment of the observation network, in order to achieve a space-time level of study of each component agreeing with its weighted significance. The conduct of studies is the most important of the stages of model development, with the aim of using equipment efficiently to collect a large quantity of data. Automated measurements in situ can greatly increase the effectiveness of observation and measurement of pollutants. It is suggested that reference points be created for the performance of studies in priority regions, from which methodologic and technical guidance could be provided. (Brambley-SRC)
W81-02730

MODELING THE GREAT LAKES - A HISTORY OF ACHIEVEMENT,
Great Lakes Basin Commission, Ann Arbor, MI.
W. C. Sonzogni, and T. M. Heidtke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, August 27-30, 1979, Bloomfield Hills, MI. EPA Report 600/9-80-033, July, 1980. p 9-36, 3 Tab, 98 Ref.

Descriptors: *Model studies, *Great Lakes, *Water quality, *Water circulation, Heated water, Poisons, Nonpoint pollution sources, Management planning, Eutrophication, Water quality, Phosphorus, Research priorities.

In an attempt to supplement and update other Great Lakes modeling reviews and to identify areas of relative strength and weakness in using current modeling technology to assist in the study of specific Great Lakes problems, over 100 models were identified in a literature survey. The models can be categorized into water quality; circulation/transport; heated effluent dispersion; toxic substances; nonpoint source; and other models. Most of the models are in the first two categories. The greatest constraint on the use of the models is the inherent difficulty associated with model verification. However, they are of great value in real planning situations, such as eutrophication in Lakes Erie and Ontario, policy and resource management decision making, and the formulation of desirable phosphorus loads or inputs into the lakes given different conditions of lake water quality. Future modeling efforts should be directed toward toxic chemicals, the nearshore area, and developing models which can be used practically to arrive at management decisions. (Brambley-SRC)
W81-02731

7B. Data Acquisition

OPTIMAL SAMPLING FOR LONG TERM TRENDS IN LAKE HURON,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
D. M. Dolan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, August 27-30, 1979, Bloomfield Hills, MI. EPA Report 600/9-80-033, July, 1980, p 58-70. 2 Fig, 5 Tab, 21 Ref.

Descriptors: *Model studies, Water sampling, *Cost analysis, Tributaries, *Water pollution sources, Nutrients, Radioisotopes, Heavy metals, Suspended solids, Great Lakes, *Lake Huron.

The Lake Huron Surveillance Plan calls for intensive sampling of the main lake in 1980, 1989, and 1998, and sampling of the major tributaries each year, so that long term changes may be detected. There is a trade-off between accuracy and funds required so a method is required to optimize the sampling program to obtain the necessary accuracy at minimum cost. A dynamic mass balance model is to be used with the Kalman filter to provide estimates of lake concentrations. Three types of measurement can be made: sampling of the open lake; tributary and point source sampling; and all field and laboratory measurements that improve the accuracy of the mass balance model. For nutrients, the northern segment of the lake is oversampled, while the southern segment is undersampled. This situation can be improved by increasing the number of stations in the southern segment, or by improving the model to be used with the Kalman filter to obtain estimates of trends. These results are probably generalizable to other parameters that could be described well by a simple mass balance, such as conservative substances, radionuclides, some heavy metals, and suspended solids. Biological parameters and certain organic contaminants would require a more sophisticated approach. (Brambley-SRC)
W81-02733

AIRCRAFT REMOTE SENSING OF SOIL MOISTURE AND HYDROLOGIC PARAMETERS, CHICKASHA, OKLA., AND RIESEL, TEX., 1978 DATA REPORT,
Science and Education Administration, Beltsville, MD. Hydrology Lab.
For primary bibliographic entry see Field 2G.
W81-02782

SNOWPACK MONITORING IN NORTH AMERICA AND EURASIA USING PASSIVE MICROWAVE SATELLITE DATA,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
J. L. Foster, A. Rango, D. K. Hall, A. T. C. Chang, and L. J. Allison.
Remote Sensing of Environment, Vol 10, No 4, p 285-298, 1980. 11 Fig, 8 Ref.

Descriptors: *Satellites(Artificial), *Snow surveys, Monitoring, *Remote sensing, Microwaves, Data collection, Snowpacks, Snow cover, North America, Eurasia.

Passive microwave data from satellite monitoring was correlated with snow depth in four study areas--the Canadian high plains, Montana and North Dakota high plains, and the steppes of central Russia. Each area is relatively flat and homogeneous. Microwave brightness temperature correlated with snow depth within each area, but relationships could not be applied to another area because factors such as snow water equivalent, density, liquid water within the pack, grain and crystal sizes, ground cover, soil conditions, and surface temperatures affect the brightness temperature. Nimbus-6 (0.81 cm wave length) ESMR data produced higher correlations than Nimbus-5 (1.55 cm wave length) ESMR data. Qualitative monitoring of snow pack buildup and disappearance in a given area by this method appears feasible. (Cassar-FRC)
W81-02869

7C. Evaluation, Processing and Publication

SURFICIAL GEOLOGY OF NEW HAVEN QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Syracuse Univ., NY.
E. H. Muller, and T. S. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $2.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-1208 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, Natural resources, *New York, Hydrogeology, Water wells, Water yield, Maps, *Oswego County(NY), *New Haven quadrangle(NY).

The location and extent of 13 kinds of surficial deposits in New Haven quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for groundwater development at any specific location. (USGS)
W81-02661

SURFICIAL GEOLOGY OF ORWELL QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. S. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $2.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-1116 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, Natural resources, *New York, Hydrogeology, Water wells, Water yield, Maps, *Oswego County(NY), *Orwell quadrangle(NY).

The location and extent of 11 kinds of surficial deposits in Orwell quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for groundwater development at any specific location. (USGS)
W81-02662

SURFICIAL GEOLOGY OF PART OF LYSANDER QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Syracuse Univ., NY.
E. H. Muller, and T. S. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $2.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-1117 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, Natural resources, *New

York, Hydrogeology, Water wells, Water yield, Maps, *Oswego County(NY), *Lysander quadrangle(NY).

The location and extent of seven kinds of surficial deposits in part of Lysander quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for groundwater development at any specific location. (USGS)
W81-02663

SURFICIAL GEOLOGY OF REDFIELD QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Syracuse Univ., NY.
R. J. Jordan, and T. S. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $2.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-1118 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, Natural resources, *New York, Hydrogeology, Water wells, Water yield, Maps, *Oswego County(NY), *Redfield quadrangle(NY).

The location and extent of eight kinds of surficial deposits in Redfield quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for groundwater development at any specific location. (USGS)
W81-02664

SURFICIAL GEOLOGY OF PART OF BOYLSTON CENTER QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. S. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $2.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-1115 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, Natural resources, *New York, Hydrogeology, Water wells, Water yield, Maps, *Oswego County(NY), *Boylston Center quadrangle(NY).

The location and extent of seven kinds of surficial deposits in part of Boylston Center quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for groundwater development at any specific location. (USGS)
W81-02665

SURFICIAL GEOLOGY OF PART OF SANDY CREEK QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. S. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $2.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-1114 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, Natural resources, *New York, Hydrogeology, Water wells, Water yield, Maps, *Oswego County(NY), *Sandy Creek quadrangle(NY).

The location and extent of 11 kinds of surficial deposits in part of Sandy Creek quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for groundwater development at any specific location. (USGS)
W81-02666

SURFICIAL GEOLOGY OF PART OF WORTH CENTER QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. S. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $2.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-967 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, Natural resources, *New York, Hydrogeology, Water wells, Water yield, Maps, *Oswego County(NY), *Worth Center quadrangle(NY).

The location and extent of six kinds of surficial deposits in part of Worth Center quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for groundwater development at any specific location. (USGS)
W81-02667

SURFICIAL GEOLOGY OF OSWEGO WEST QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. S. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $1.75 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-968 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, Natural resources, *New York, Hydrogeology, Water wells, Water yield, Maps, *Oswego County(NY), *Oswego West quadrangle(NY).

The location and extent of 10 kinds of surficial deposits in Oswego West quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for groundwater development at any specific location. (USGS)
W81-02668

SURFICIAL GEOLOGY OF OSWEGO EAST QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Syracuse Univ., NY.
E. H. Muller, and T. S. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $2.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-1209 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, Natural resources, *New York, Hydrogeology, Water wells, Water yield, Maps, *Oswego County(NY), *Oswego East quadrangle(NY).

The location and extent of 11 kinds of surficial deposits in Oswego East quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for groundwater development at any specific location. (USGS)
W81-02669

SURFICIAL GEOLOGY OF CENTRAL SQUARE QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Syracuse Univ., NY.
E. H. Muller, and T. S. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $2.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-2039 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, Natural resources, *New York, Hydrogeology, Water wells, Water yield, Maps, *Oswego County(NY), *Central Square quadrangle(NY).

The location and extent of 10 kinds of surficial deposits in Central Square quadrangle, Oswego, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for groundwater development at any specific location. (USGS)
W81-02670

SURFICIAL GEOLOGY OF MEXICO QUADRANGLE, OSWEGO COUNTY, NEW YORK,
Syracuse Univ., NY.
E. H. Muller, D. Andrews, and T. S. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $2.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-2040 (WRI), 1980. 1 Sheet.

Descriptors: *Geology, *Glacial aquifers, *Groundwater potential, Natural resources, *New York, Hydrogeology, Water wells, Water yield, Maps, *Oswego County(NY), *Mexico quadrangle(NY).

The location and extent of 10 kinds of surficial deposits in Mexico quadrangle, Oswego County, N.Y., are mapped on a 7.5-minute U.S. Geological Survey topographic map. The map was compiled to indicate the lithology and potential for groundwater development at any specific location. (USGS)
W81-02671

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1979--VOLUME 2. PACIFIC SLOPE BASINS FROM ARROYO GRANDE TO OREGON STATE LINE EXCEPT CENTRAL VALLEY.
Geological Survey, Menlo Park, CA. Water Resources Div.
Geological Survey Water-Data Report CA-79-2, January 1981. 509 p, 3 Fig.

Descriptors: *California, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Pacific slope basins.

Volume 2 of water resources data for the 1979 water year for northeastern California consists of records of stage, discharge, and water quality of streams and wells; stage, contents, and water quality in lakes and reservoirs; and water levels in wells. This report contains discharge records for 155 gaging stations, stage and contents for 20 lakes and reservoirs, water quality for 131 stations and 17 wells, and water levels for 85 observation wells. Also included are 8 crest-stage partial-record stations and 8 low-flow partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (USGS)
W81-02672

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1979--VOLUME 3. SOUTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM WALKER RIVER TO TRUCKEE RIVER.
Geological Survey, Menlo Park, CA. Water Resources Div.
Geological Survey Water-Data Report CA-79-3, January 1981. 417 p, 12 Fig.

Descriptors: *California, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Great Basin, Walker River(CA), Truckee River(CA), Southern central valley basins(CA).

Volume 3 of water resources data for the 1979 water year for central California consists of records of stage, discharge, gage-height, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 182 gaging stations, stage and contents for 40 lakes and reservoirs, gage-height records for 2 lakes, water quality for 55 stations, water levels for 44 observation wells, and water quality for 4 wells. Also included are 11 crest-stage partial-record stations and 4 water-quality partial-record stations. Additional water data were collected which are not part of the systematic data-collection program. It is published as a special investigation. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (USGS)
W81-02673

WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1980--VOLUME 2. SOUTHERN LOUISIANA.
Geological Survey, Baton Rouge, LA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-186033, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report LA-80-2, 1980. 371 p, 15 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Louisiana, *Southern Louisiana.

Water resources data for the 1980 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report, in three volumes, contains records for water discharge at 75 gaging stations (including stage for 71 of these stations); stage only for 38 gaging stations and 11 lakes; contents for 1 reservoir; water quality for 124 surface-water stations (including 34 gaging stations), 107 miscellaneous sites, 15 lakes, and 268 wells; and water levels for 506 observation wells. Also included are data for 271 crest-stage and flood-profile partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States are also included in this report. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Louisiana. (USGS)
W81-02674

GROUND-WATER QUALITY AND DATA ON WELLS AND SPRINGS IN PENNSYLVANIA, VOLUME I--OHIO AND ST. LAWRENCE RIVER BASINS,
Geological Survey, Harrisburg, PA. Water Resources Div.
H. E. Koester, and D. R. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $12.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1119, November 1980. 95 p, 15 Fig, 15 Tab, 2 Ref.

Descriptors: *Groundwater, *Water quality, Hydrologic data, Water wells, *Well data, *Pennsylvania, Springs, Aquifers, Water levels, Elevation, Water yield, Geohydrologic units, Sites, Chemical analysis, Trace elements, *Ohio River basin(PA), *St. Lawrence River basin.

Volume I of the Groundwater Quality and Data on Wells and Springs in Pennsylvania presents groundwater quality and physical data on about 1,200 well and spring sites in the Ohio and St. Lawrence River basins. Locations are shown on site-location maps derived from the hydrologic unit map. Codes showing the geologic age and aquifer are provided. (USGS)
W81-02675

STREAMFLOW STATISTICAL SUMMARIES FOR COLORADO STREAMS THROUGH SEPTEMBER 30, 1975, VOLUME 2: COLORADO RIVER BASIN ABOVE GUNNISON RIVER,
Geological Survey, Lakewood, CO. Water Resources Div.
H. E. Petsch, Jr.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $46.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 79-1060, 1980. 350 p, 3 Fig, 2 Tab, 15 Ref.

Descriptors: *Hydrologic data, *Streamflow, Streams, *Colorado, *Gaging stations, Surface waters, Flow duration, Discharge(Water), High flow, Low flow, Flow characteristics, Statistics, Annual, Monthly, Data collections, *Colorado River basin(CO).

Statistical summaries of daily streamflow data for 189 stations west of the Continental Divide in Colorado are presented in this report. Duration tables, high-flow sequence tables, and low-flow sequence tables provide information about daily mean discharge. The mean, variance, standard deviation, skewness, and coefficient of variation are provided for monthly and annual flows. Percentages of average flow are provided for monthly flows and first-order serial-correlation coefficients are provided for annual flows. The text explain the nature and derivation of the data and illustrates applications of the tabulated information by examples. The data may be used by agencies and individuals engaged in water studies. (USGS)
W81-02676

SELECTED CHEMICAL QUALITY CHARACTERISTICS IN STREAMS OF KENTUCKY, 1970-75.
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 2K.
W81-02680

MEASUREMENTS OF DISCHARGE, GAIN OR LOSS IN FLOW, AND CHEMICAL QUALITY OF THE POPLAR AND REDWATER RIVERS, NORTHEASTERN MONTANA, OCTOBER 24-25, 1979,
Geological Survey, Helena, MT. Water Resources Div.
K. A. Dodge, and G. W. Levings.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $2.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1210, November 1980. 16 p, 2 Fig, 3 Tab.

Descriptors: *Discharge measurement, Flow measurement, *Water quality, *Streams, *Montana, Flow rates, *Streamflow, Base flow, Specific conductivity, Water temperature, Surface-groundwater relationships, Data collections, Sampling, Sites, Chemical analysis, *Poplar River(MT), *Redwater River(MT).

Discharge, specific conductance, and water temperature were measured at 37 sites on the Poplar and Redwater Rivers in northeastern Montana on October 24-25, 1979, to provide data on the interaction between surface-water and groundwater systems. Streamflow gains or losses were computed for those stream reaches not significantly affected by irrigation. Water samples were collected at 17 of the sites for detailed chemical-quality analysis. The tabulated data provide an areally broad data base of concurrent base-flow conditions. (USGS)
W81-02682

HYDROLOGIC AND CLIMATOLOGIC DATA, SOUTHEASTERN UINTA BASIN, UTAH, AND COLORADO, WATER YEAR 1978,
Geological Survey, Salt Lake City, UT. Water Resources Div.
L. S. Conroy.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $21.25 in paper copy, $5.50 in microfiche. Geological Survey Open-File Report 80-1025, 1980. 166 p, 6 Fig, 8 Tab, 2 Ref.

Descriptors: *Hydrologic data, *Climatic data, *Colorado River basin, *Utah, *Colorado, Available water, Surface waters, Groundwater, Water quality, Precipitation(Atmospheric), Snow surveys, Streamflow, Flow rates, Water wells, Water yield, Water levels, Temperature, Specific conductivity, Water analysis, Chemical analysis, Southeastern Unita basin.

This report contains data collected in the vicinity of the oil-shale area in the southeastern Uinta Basin, Utah and Colorado, from Oct. 1, 1977, to Sept. 30, 1978. The data presented in tables, include monthly precipitation, depth-duration of rainfall, snow depth and water content, air temperature, daily streamflow records, water-quality data from continuous-recording gaging sites, water-quality data for wells and springs, and water levels, temperature, and specific conductance for selected wells. (USGS)
W81-02694

SUMMARY OF HYDROLOGIC DATA FOR THE EAST EVERGLADES, DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. J. Schneider, and B. G. Waller.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $10.75, in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1292, 1980. 73 p, 56 Fig, 3 Tab, 4 Ref.

Descriptors: *Hydrologic data, *Swamps, *Rainfall, *Community development, *Florida, Water control, Discharge(Water), Water levels, Water table, Duration curves, Hydrographs, Water management(Applied), Everglades, *Dade County(FL).

The East Everglades area in south-central Dade County, Fla., occupies approximately 240 square miles. The area is flat and low lying with elevations ranging from sea level in the southeast part to 10 feet at Chekika Hammock with an average elevation of about 6 feet. Rainfall in the area averages 57.9 inches a year with about 80% of the total falling during the May to October wet season. There is some residential development and farming in the east-central part of the area where land elevations are slightly higher. Pressure by agricultural, commerical, and housing interests to develop the area is increasing. Historically, most of the area was flooded for extended periods of time. The construction of canals, levees, and controls has lowered the average water levels of the area. This has reduced the extent and decreased the time of flooding. Long-term hydrographs show graphically the effects that the water control works have had on the hydrologic system. The change in discharge into the north end of the East Everglades through the Tamiami Canal outlets, Levees 30 to 67A, due to construction is very pronounced. Maps showing the altitude of the water table for wet and dry periods indicate that Levee 67 Extended Canal greatly influences the water levels and shape of the water-table contours in the northwestern part of the East Everglades. (USGS)
W81-02697

WATER RESOURCES DATA FOR NEVADA, WATER YEAR 1979.
Geological Survey, Carson City, NV. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-188740, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NV-79-1, November, 1980. 388 p, 9 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical anal-

ysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Nevada.

Water resources data for the 1979 water year for Nevada consist of records of discharge and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 128 gaging stations; stage and contents for 20 lakes and reservoirs; water-quality data for continuing-record stations at 27 stream sites and 1 lake site and for partial-record stations at 71 stream sites, 3 lake sites, 8 wells, and 1 spring; and water levels for 208 observation wells. Also included are 78 crest-stage partial-record stations and 13 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Nevada. (USGS)
W81-02698

HYDROLOGIC MAPS AND DATA FOR SANTA FE COUNTY, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
W. A. Mourant.
New Mexico State Engineer Basic Data Report, 1980. 180 p, 4 Fig, 3 Tab.

Descriptors: *Groundwater resources, *Hydrologic data, *Maps, *New Mexico, *Data collections, Water wells, Water levels, Contours, Springs, Sites, Specific conductivity, Chemical analysis, *Santa Fe County.

This report contains hydrologic and geologic data that will be useful in future quantitative studies of the water resources of Santa Fe County, N.Mex. It lists well and spring data, including well locations, water levels, and chemical analyses of well and spring water. Illustrations in the report include maps showing locations of wells and springs with water-level contours, and specific conductance of well and spring water. (USGS)
W81-02703

FIELD DATA DESCRIBING THE MOVEMENT AND STORAGE OF SEDIMENT IN THE EAST FORK RIVER, WYOMING. PART I. RIVER HYDRAULICS AND SEDIMENT TRANSPORT, 1979,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2J.
W81-02704

FIELD DATA DESCRIBING THE MOVEMENT AND STORAGE OF SEDIMENT IN THE EAST FORK RIVER, WYOMING. PART II. BED ELEVATIONS, 1979,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2J.
W81-02705

WATER RESOURCES DATA FOR ALABAMA, WATER YEAR 1979--VOLUME 1. APALACHICOLA, CHOCTAWATCHEE, BLACKWATER, ESCAMBIA, PERDIDO, AND ALABAMA RIVER BASINS.
Geological Survey, University, AL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-179632, Price codes: A11 in paper copy, A01 in microfiche. Geological Survey Water-Data Report AL-79-1, October, 1980. 231 p, 7 Fig, 1 Tab.

Descriptors: *Alabama, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, Appalachicola River basin, Choctawhatchee River basin, Blackwater River basin, Escambia River basin, Perdido River basin, Alabama River basin, Mobile River basin.

Water resources data for the 1979 water year for Alabama consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. This report, in two volumes, contains discharge records for 99 gaging stations, stage only for 23 gaging stations, stage and contents for 12 lakes and reservoirs, water quality for 71 gaging stations, and water levels for 53 observation wells. Also included are 24 low-flow partial-record stations, 20 crest-stage partial-record stations, 11 flood hydrograph partial-record stations, and 112 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alabama. (USGS)
W81-02706

WATER RESOURCES DATA FOR ALABAMA, WATER YEAR 1979--VOLUME 2. TOMBIGBEE, MOBILE, DOG, PASCAGOULA, AND TENNESSEE RIVER BASINS.
Geological Survey, University, AL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-179640, Price codes: A20 in paper copy, A01 in microfiche. Geological Survey Water-Data Report AL-79-2, October, 1980. 454 p, 7 Fig, 1 Tab.

Descriptors: *Alabama, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, Dog River basin, Tombigbee River basin, Mobile River basin, Pascagoula River basin, Tennessee River basin.

Water resources data for the 1979 water year for Alabama consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. This report, in two volumes, contains discharge records for 99 gaging stations, stage only for 23 gaging stations, stage and contents for 12 lakes and reservoirs, water quality for 71 gaging stations, and water levels for 53 observation wells. Also included are 24 low-flow partial-record stations, 20 crest-stage partial-record stations, 11 flood hydrograph partial-record stations, and 112 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alabama. (USGS)
W81-02707

DATA MANAGEMENT REQUIREMENTS FOR GREAT LAKES WATER QUALITY MODELING,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
W. L. Richardson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, August 27-30, 1979, Bloomfield Hills, MI. EPA Report 600/9-80-033, July, 1980, p 37-57. 8 Fig, 3 Tab, 13 Ref, 3 Append.

Descriptors: *Great Lakes, *Water quality, *Model studies, Data collections, *Data storage and retrieval, Data processing, Information systems, Information exchange, Water quality management, Lakes, Eutrophication, Costs.

Efficient data management is essential to water quality managment and research programs, requiring adequate staff and budget provisions for its implementation, regardless of the purpose to which the data are being applied. For the Great Lakes, water quality information is maintained in the STORET on-line data base system. It contains data collected by the U.S. participants in the Great Lakes Surveillance Plan, and all the open lake data collected by the Canadian Center for Inland Waters. The amount of information for the years prior to and including 1960, and 1961-1979 is given for each lake and the connecting channels, and a summary of Great Lakes eutrophication data is presented. Accurate and timely data processing plays a key role in the modeling process, subject to proper surveillance design. It is suggested that about 10% of total project costs be devoted to data management. (Brambley-SRC)
W81-02732

PRINCIPLE OF ORGANIZATION OF AN AUTOMATED INFORMATION SYSTEM,
Gidrokhimicheskii Inst., Rostov-na-Donu (USSR).
V. L. Pavelko.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118374, Price codes: A18 in paper copy, A01 in microfiche. In: Proceedings of the Second American-Soviet Symposium on the Use of Mathematical Models to Optimize Water Quality Management, August 27-30, 1979, Bloomfield Hills, MI. EPA Report 600/9-80-033, July, 1980. p 197-206, 1 Fig, 2 Ref.

Descriptors: *Data collections, *Information systems, *Computers, *Water quality, *Ecological effects, Water pollution, Hydrologic data, Hydrobiology, Water chemistry, Monitoring, Data storage and retrieval.

A major problem of testing and control of the environment is the creation of an automated information system (AIS) for water quality as a section of a more general ecologic information system. The flow of information determines the external conditions of existence of the processes which we are studying. These, in turn, define the function of the source of a pollutant and are a response to the condition of water objects, and will be referred to as accompanying flows. These flows of information are related to hydrochemical subjects as follows: external conditions, such as hydrologic flow, meteorology, and hydrobiologic data; source function, such as data on waste waters, pollution of the atmosphere and soil, hydrogeologic data, sedimentation, burial of pollutants, and hydrobiologic characteristics; and response, such as sanitary-hygienic data, hydrobiologic data, ichthyologic data, industrial water use, and marine hydrochemistry. The principles which were used in the creation of the AIS-hydrochemistry system are summarized. Included are some of the results obtained, which are recommended as principles for the creation of a global monitoring AIS, which is expected will ultimately include all nations. (Moore-SRC)
W81-02740

8. ENGINEERING WORKS

8A. Structures

SAFETY EVALUATION OF EXISTING DAMS, A MANUAL FOR THE SAFETY EVALUATION OF EMBANKMENT AND CONCRETE DAMS.
Water and Power Resources Service, Denver, CO. Water Resources Technical Publication, 1980. 164 p, 2 Fig, 33 Ref, 3 Append.

Descriptors: Concrete dams, Earth dams, Rockfill dams, *Dams, *Safety, *Inspection, Embankments, Hydraulic structures, Dam failure, Dam design, Dam stability, On-site investigations, Dam construction, *Dam stability, Evaluation.

The purpose of the SEED (Safety Evaluation of Existing Dams) Program is to comprehensively review the design, construction, and performance history of all Water and Power Resources Service dams, to evaluate their structural and hydraulic integrity, and to determine any need for remedial actions. This manual is intended to provide engineering and technical personnel at all levels of

government (Federal, State, and local) and private engineering organizations with sound, comprehensive guidelines and procedures for the inspection and evaluation of public and private dams. The manual sets forth guidelines for: scope and frequency of evaluations; team selection and responsibilities; preparing and updating Data Books; evaluating design, construction, and operations; making field examinations; developing conclusions and recommendations; and preparing reports. The design of the dam and appurtenant structures should be reviewed to assess the actual performance compared to the intended performance. Engineering data and records originating during the construction period should be reviewed to determine if the structures were constructed as designed. A field examination and review of available instrumentation records also should be made to assess the actual performance of the structures. Sample field examination checklists are provided for both embankment dams and concrete dams. (Moore-SRC)
W81-02774

8C. Hydraulic Machinery

ALGORITHMS FOR PIPE NETWORK ANALYSIS AND THEIR RELIABILITY,
Kentucky Water Resources Research Inst., Lexington.
D. J. Wood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-193971, Price codes: A05 in paper copy, A01 in microfiche. Research Report No 127, March 1981. 108 p, 6 Fig, 21 Tab, 19 Ref. OWRT-B-060-KY(1), 14-34-0001-9114.

Descriptors: *Water distribution, *Pipe flow, Pipelines, Networks, *Steady flow, Pumps, Pipe network, *Algorithms, Convergence, Pipe network analysis.

Algorithms for analyzing steady state flow conditions in pipe networks are developed for general applications. The algorithms are based on both equations expressed in terms of unknown flowrates and node equations expressed in terms of unknown grades. Five methods, which represent those in significant use today, are presented. An example pipe network is analyzed to illustrate the application of the various algorithms. The various assumptions required for the different methods are presented and the methods are compared within a common framework. The reliabilities of these commonly employed algorithms for pipe network analysis are investigated by analyzing a large number of pipe networks using each of the algorithms. Numerous convergence and reliability problems are documented. It is shown that two methods based on loop equations have superior convergence characteristics. Methods based on node equations are less reliable and these methods are often unable to adequately handle low resistance lines. A discussion of convergence criteria and solution reliability is presented for the various algorithms. The results presented in this report will allow engineers to accurately carry out pipe network analysis.
W81-02658

APPLICATION OF WIND ENERGY TO GREAT PLAINS IRRIGATION PUMPING,
Science and Education Administration, Manhattan, KS. North Central Region.
L. J. Hagen, L. Lyles, and E. L. Skidmore.
Advances in Agricultural Technology AAT-NC-4, January 1980. 24 p, 23 Fig, 7 Tab, 27 Ref.

Descriptors: *Pumping, *Irrigation efficiency, *Wind energy, *Irrigation wells, Wind velocity, Sprinkler irrigation, Computer programs, Irrigation requirements, Economic efficiency, Well yield, Fuel, Nebraska, Kansas, Texas, Wheat, Corn, Case studies.

A computer program was developed to simulate operation of wind-powered irrigation wells. Pumping by wind turbine systems was simulated for two variable and two constant flow operational modes in which auxiliary motors were used in three of the modes. A comparison was made among the four modes of well yields and maximum pumping rates as a function of drawdown in a typical well. The program also was used to determine monthly well yields using a 250 sq m swept area wind turbine system in each mode if located at Columbus, Nebraska, Garden City, Kansas and Amarillo, Texas. The percentage of fossil fuel replaceable by wind energy was calculated for the most efficient constant and variable flow modes. Wind powered systems could supply half or more of the Great Plains irrigation energy demand using the present mix of sprinkler and surface distribution systems. Proper irrigation management is important to maximize wind energy use. Fully irrigated summer crops with preplant irrigation will use 30 to 60% of the annual, capturable wind energy, depending on crop and location. Fully irrigated equal areas of corn and winter wheat will use 70 to 85% of the wind energy, depending on location. With limited irrigation, 50 to 100% of the wind energy can be used, depending on practices followed. (Moore-SRC)
W81-02781

8I. Fisheries Engineering

A SOLAR HEATED FISH HATCHERY WATER RECYCLING SYSTEM,
Sea Run, Inc., Kennebunkport, ME.
E. S. Sawyer, and P. J. Sawyer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-196750, Price codes: A03 in paper copy, A01 in microfiche. Office of Water Research and Technology Report OWRT-RU-81/3, July, 1980. 31 p, 9 Fig, 5 Tab, 12 Ref. OWRT-C-80165-R(No 8811)(1), 14-34-0001-8811.

Descriptors: *Water reuse, *Aquaculture, *Fish hatcheries, *Solar radiation, Biological filters, Chemical treatment, Smolt, Trout, Water consumption, Growth.

The purpose of this project was to rear smolts, young salmonids large enough for seawater entry, in a water recycling hatchery. High reuse was necessary to overcome temperature and groundwater limitations in coastal Maine and New Hampshire. Four rearing units were operated in a partially underground building. Each unit consisted of a 2,000 gallon fish tank and 500 gallon flooded biological filter, and reared 20,000 to 25,000 rainbow trout to smolt size (4 inches). Water consumption averaged 10 gallon/day/unit compared to 57,000 gallon/day/unit in a flow-through hatchery. Solar heating of water to accelerate fish growth resulted in shortening production time for a 4 inch fish from 18 months to 6 months. Costs/unit were approximately the same as those of a flow-through hatchery that must pump water, and considerably less than a flow-through hatchery that must heat water.
W81-02709

THE WRRI TROUT COVER RATING METHOD: DEVELOPMENT AND APPLICATION,
Wyoming Univ., Laramie. Water Resources Research Inst.
T. A. Wesche.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198368, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Series No 78, December, 1980. 46 p, 9 Fig, 5 Tab, 9 Ref, Append. OWRT B-032-WYO(2), 14-34-0001-6135.

Descriptors: Brown trout, Brook trout, Colorado River cutthroat trout, *Trout, Water depth, Flow rates, Streams, Surveys, *Instream flow, *Trout habitat, *Trout cover, Environmental effects.

Trout cover can generally be described as object-oriented, having a water depth of at least 0.5 feet, a point water velocity of less than 0.5 feet per second, and a mean water velocity of less than 1.0 feet per second. Brown trout were found to be more cover-oriented than are brook or Colorado River cutthroat trout. A significant positive relationship was found to exist between the amount of cover available and the standing crops of brown trout. For measuring available cover in smaller streams (average discharge less than 100 cfs), the basic WRRI Cover Rating (WCR) Method is recommended. For larger streams, the modified WCR Method (including a 'deep-water' factor) is best suited. Step-by-step instructions for the use of both methods are presented in the Appendix.
W81-02717

TEMPERATURE-CONTROLLED RECIRCULATING SYSTEM FOR HATCHING CATOSTOMID LARVAE,
Purdue Univ., Lafayette, IN. Dept. of Forestry and Natural Resources.
K. D. Curry, and A. Spacie.
The Progressive Fish-Culturist, Vol 42, No 3, p 151-152, July, 1980. 1 Fig, 4 Ref. OWRT A-052-IND(3).

Descriptors: *Temperature control, *Fish hatcheries, Fish eggs, Suckers, Catostomid, Larvae, *Fish hatching system.

A brief note describes a temperature-controlled recirculating fish hatching system. The principal parts of the unit are refrigeration unit, submersible pumps, the aquaria and floating egg cups. The system enables tempeature control between 2 and 21C. Water temperature can easily be adjusted to match stream temperatures prevailing where fish eggs are collected and fertilized.
W81-02728

AQUACULTURE: CATFISH AND TROUT, INVENTORY AND SALES, 1980.
Economics and Statistics Service, Washington, DC. Crop Reporting Board.
Statistical Bulletin 644, October 1980. 12 p, 15 Tab.

Descriptors: *Fish farming, *Trout, *Surveys, *Catfish farming, Fish harvest, Water use, *Aquaculture, Water supply, Water requirements, Economic evaluation.

Selected state estimates of catfish and trout inventories as of August 1, 1980, and sales from January 1 through July 31 were prepared from a survey conducted in late August. A probability sample of about 1,330 was selected from a list of all known commercial producers and an area frame sample was used to estimate for producers not on the list. Catfish were produced in 10 states, in which 43.4 million pounds were sold with a value of $33.8 million. Producers were using 56,200 acres of water surface and reported intentions to expand operations by 16,100 acres during 1981. The primary source of water supply was from wells followed by rain and/or watershed. Trout growers in 9 selected states sold 28.5 million pounds of trout valued at $24.6 million. Producers planned to extend the current utilization of 63.0 million cubic feet by 4.16 million cubic feet in 1981. The primary water source was springs followed by wells. (Brambley-SRC)
W81-02776

AQUACULTURE: OPPORTUNITIES FOR AN EXPANDED INDUSTRY IN ILLINOIS,
Illinois Natural History Survey, Urbana.
R. W. Gordon, and R. E. Westgren.
Illinois Institute of Natural Resources, Chicago. Document No 80/18, December, 1980. 118 p, 4 Fig, 28 Tab, 56 Ref, 3 Append.

Descriptors: *Illinois, *Aquaculture, *Catfish ponds, *Fish farming, *Commercial fishing, Fish ponds, Catfish, Carp, Trout, Eel, Frogs, Plankton, Algae harvesting, Animal diseases, Strip mine lakes.

Aquaculture---growing aquatic organisms in freshwater systems---appears practical, feasible, and potentially profitable in Illinois. For example, results of recent studies suggest that good aquaculture businessmen who raise catfish that retail for $2.80/pound may expect annual profits ranging from $625 to $1,250 per hectare. Small operations are less likely to be profitable than larger systems, due

to various fixed costs; catfish ponds of 20-acre size with multiple ponds are recommended. In addition to pond culture, aquaculture systems in raceways, silos, and cages are discussed, and economic estimates are given for trout and perch as well as for catfish. In Illinois, fewer than 200 acres of water are currently used for the culture of commercial catfish. In contrast, Arkansas and Mississippi have more than 25,000 acres of ponds in use for catfish production. Several economic obstacles affect the growth of Illinois's aquaculture industry, such as land costs, taxes, interest costs, and alternative uses for farmland. Other obstacles are lack of knowledge, insufficient marketing and service support for entrepreneurs, and a current lack of support from bankers and agricultural supply firms. The report suggests using other states as models to overcome these obstacles, with the goal of developing an industry that is a viable branch of agriculture in Illinois. (Garrison-Omniplan)
W81-02797

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

COWEETA HYDROLOGIC LABORATORY, 1934-2034: PAST, PRESENT AND FUTURE,
Southeastern Forest Experiment Station, Franklin, NC. Coweeta Hydrologic Lab.
J. E. Douglass, and D. G. Neary.
In: Proceedings of the Helsinki Symposium, June, 1980. IAHS-AISH Publication No 130, p 61-65. 6 Ref.

Descriptors: *Coweeta Hydrologic Laboratory, North Carolina, *Appalachian Mountain Region, *Forestry, *Hydrology, *Research facilities, Research priorities, Rainfall, Runoff, Water resources, Water yield, Water quality, Models, Water pollution sources, Forest managment, Ecosystems.

The early research at Coweeta Hydrologic Laboratory, North Carolina, emphasized calibration of basins and establishment of rainfall-runoff patterns. Subsequently land use, forest cutting and species conversion were studied to determine their effects on water resources primarily, water yield. Integration of the results of soil, plant, atmospheric and hydrologic studies led to the development of process models for the simulation of streamflow. Current studies emphasize water quality rather than water quantity, focusing on mineral cycling and nonpoint source pollution. Mineral cycling is investigated to understand and assess the consequences of specific forest management practices on terrestrial and aquatic ecosystems and to determine the effects of alternative levels of timber utilization on future productivity of the system. Future projects will continue the trend toward short-term studies relating alternative management practices to water quality. Coweeta will continue to be used for studying basic hydrological processes, for testing improved models and for paired basin studies of hydrological and ecological problems. (Brambley-SRC)
W81-02729

USGS: ITS WATER RESOURCES RESEARCH ACTIVITY,
S. Miller.
Environmental Science and Technology, Vol 15, No 2, p 140-142, February, 1981.

Descriptors: *Research, *Water resources, *United States Geological Survey, *Research facilities, Projects, Hydrology, Model studies, Water pollution, Waste disposal.

The Water Resources Division of the U.S. Geological Survey has 2900 employees, 373 of whom are engaged in research. There are 46 district offices through which the federal-state cooperative programs are implemented. Each of the four regional research centers studies a wide range of hydrologic problems and specializes in certain disciplines. The Gulf Coast Hydroscience Center's area of expertise is mathematical modeling for transfer and fate of organic pollutants in water resources. The Reston, Va., office concentrates on geochemical and groundwater research. The Denver center focuses on sediment research, groundwater transfer, and the fate of pollutants. Biology and geothermal studies are specialties of the Menlo Park, Cal., office. Proposed research programs involve droughts, tidal freshwater streams, lakes, water use data applications, and hydrologic factors associated with volcanic activity. Continuing attention will be given to hazardous waste disposal, acid rain, groundwater contamination, and cold region hydrology. (Cassar-FRC)
W81-02839

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

WATER RESOURCES THESAURUS, THIRD EDITION.
Office of Water Research and Technology, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198376, Price codes: A07 in paper copy, A01 in microfiche. Publication OWRT IT-80/1, 1980. 132 p.

Descriptors: *Thesauri, *Information systems, *Indexing, *Information retrieval, *Water resources, Vocabularies, Computers, Abstracting, On-line retrieval, On-line searching, Libraries, Publications, Research, Technology transfer, Technology.

The third edition of the Water Resources Thesaurus, which represents a major revision of the previous 1971 edition, provides a vocabulary for indexing and retrieving the literature of water resources research and development. The terms in this edition were selected from the more than 105,000 indexing terms used in the 'Selected Water Resources Abstracts'. Some high frequency terms were excluded because they were too broad or ambiguous. Also deleted were the names of specific legislative acts, rivers, oceans, bays, birds, and most chemical terms. Due to changes in retrieval capability, such as text searching, this edition emphasizes terms useful for classifying or grouping specifics because such terms are needed in selecting subsets, but may not appear in the abstract. The Thesaurus has three sections: Thesaurus of Descriptors, Descriptor Words, and Descriptor List. The Thesaurus of Descriptors, the main indexing and retrieval tool, is an alphabetical list of terms interfiled with five types of cross-references: USE, Used For, Broader Term, Narrower Term, and Related Term. Descriptor Words is an alphabetical listing of each significant word comprising a term in the Thesaurus. The Descriptor section contains all approved terms, allowing for quick verification of terms and their spelling. (Seigler-IPA)
W81-02718

10D. Specialized Information Center Services

DIRECTORY OF ASSISTANCE CENTERS OF THE NATIONAL WATER DATA EXCHANGE (NAWDEX),
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $3.50 in paper copy, $1.75 in microfiche. Geological Survey Open-File Report 80-1193, (supersedes Open-File Report 79-423). 1980. 10 p.

Descriptors: *Data storage and retrieval, *Information exchange, *Indexing, *Cooperatives, Assistance centers, Directory, U.S. Geological Survey, Water Resources Division, *National Water Data Exchange(NAWDEX).

The National Water Data Exchange (NAWDEX), managed by the U.S. Geological Survey, has established a network of Assistance Centers throughout th United States and Puerto Rico to assist users of water data in identifying and locating the data they need. This Directory provides the information needed to contact any of the established Centers. (USGS)
W81-02681

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